Monitoring report form for CDM project activity
(Version 09.0)

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

MONITORING REPORT			
Title of the project activity	Irani Wastewater Methane Avoidance Project		
UNFCCC reference number of the project activity	1410		
Version number of the PDD applicable to this monitoring report	4		
Version number of this monitoring report	1		
Completion date of this monitoring report	14/02/2022		
Monitoring period number	7th monitoring period		
Duration of this monitoring period	01/01/2020 to 18/01/2022		
Monitoring report number for this monitoring period	NA		
Project participants	Celulose Irani S.A.		
Host Party	Brazil		
Applied methodologies and standardized baselines	AMS-III.I. ver. 8.0 - Avoidance of methane production in wastewater treatment through replacement of anaerobic systems by aerobic systems		
Sectoral scopes	Sectoral scope 13 - Waste handling and disposal		
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013 until 31 December 2020	Amount achieved from 1 January 2021
	0 tCO_2e	23,952 tCO_2e	24,906 tCO_2e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	97,815 tCO_2e		

SECTION A. Description of project activity

A.1. General description of project activity

Purpose and general description of project activity

The former wastewater treatment system at Celulose Irani consisted of primary treatment, characterised by a series of ponds with superficial aeration – aeration in only the superficial layer of the water column – in the first pond. Except for this minimal and inefficient superficial aeration, the ponds had no other source of oxygen. It resulted in a process where wastewater and the organic compounds in it was degraded in the absence of oxygen (anaerobically), thus producing significant amount of methane.

The purpose of the project is to avoid methane emissions from the former wastewater treatment and disposal practices. The project activity reduces GHG emissions by avoiding the production of methane from wastewater that was being treated in anaerobic lagoons. With these measures, the project developer minimized anaerobic digestion of the organic wastewater in the ponds.

The project activity involved the implementation of a new wastewater treatment scheme focused on aerobic treatment. The new wastewater treatment system uses highly aerated activated sludge, which is decanted and reused. The activated sludge is a result of a process in which oxygen is forced into wastewater to develop a biological flake (or solid) which reduces the organic content of the sewage. After undergoing this biological treatment, the organic material in the wastewater eventually decreases, resulting in clean water. After the wastewater treatment, the activated sludge can be used as a fertilizer, landfilled or incinerated.

The operation starting date of the project activity is 01/01/2006.

Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period: 48,858 tCO_2e.

A.2. Location of project activity

Host Party(ies): Celulose Irani S.A.
Region/ State/ Province: Santa Catarina State
City/ Town/ Community: located in Campina da Alegria district, in the municipality of Vargem Bonita,
Physical/ Geographical location: The project is located at the Celulose Irani main industrial complex, in the Campina da Alegria integrated mill, (Rodovia BR 153, km 47 CEP: 89600-000).
GeoCoordinates: 26°51'55.42"S ; 51°47'32.73"W

Figure 1: Vargem Bonita localization (in red)

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 Party)	Celulose Irani S.A.	No

A.4. References to applied methodologies and standardized baselines

AMS-III.I. ver. 8.0 - Avoidance of methane production in wastewater treatment through replacement of anaerobic systems by aerobic systems
Link: https://cdm.unfccc.int/methodologies/DB/Z5A2LR9Q7XS906TDS4XDC8MKORZ63R

TOOL 05: "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" – Version 03.0
Link: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v3.0.pdf

TOOL 07: "Tool to calculate the emission factor for an electricity system", version 07.0
Link: https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

A.5. Crediting period type and duration

19/01/2015 - 18/01/2022 (type: renewable)

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

The project activity involves a change from the former anaerobic wastewater treatment system to an aerobic system, therefore reducing the methane emissions from anaerobic ponds.

The former wastewater treatment system at Celulose Irani consisted of a floater/decanter and anaerobic lagoons. The project activity consists on the installation of aerators, what made oxygen available for the degradation of the organic matter from the wastewater. Additionally, an activated sludge system is used, with the addition of two other decanters, speeding up the reaction. All this minimizes the occurrence of anaerobic reactions.

The figure below highlights the part of the former wastewater treatment system that suffered the major changes, at Celulose Irani plant. The blue arrow indicates the entrance of the wastewater in the treatment and the black arrows indicates the flow of the water throughout the system.

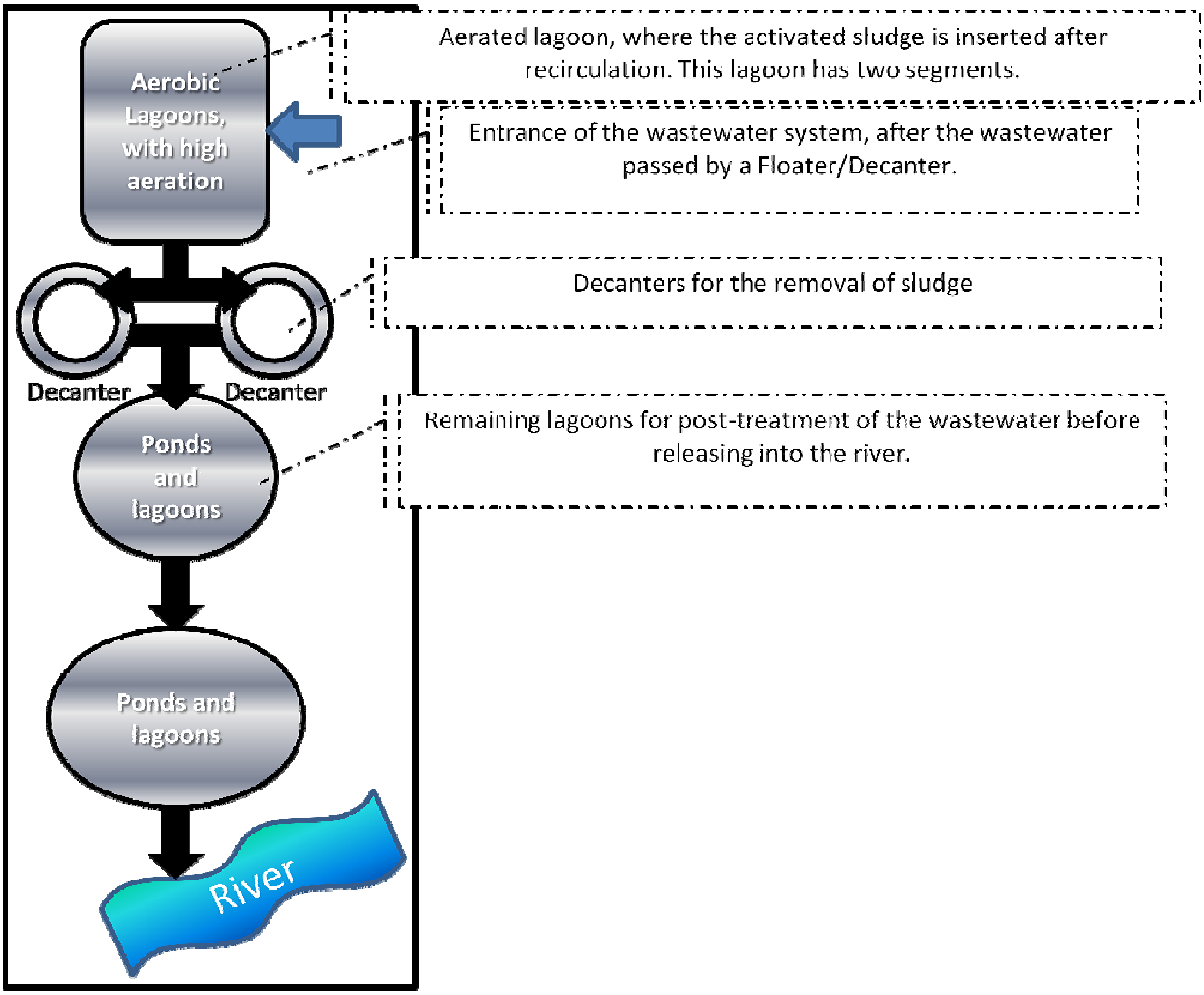

Figure 2: Project Activity wastewater system summary

There were no special events during the monitoring period. No equipment was exchanged or overhauled.

The only operational difference related to the project activity was in the amount of months with average temperature below 15ºC. There were fewer occurrences of this situation when compared to those expected in the PDD (expectations based on historical temperature values), but the monitoring system was not by any means compromised.

No events occurred that affected the applicability of the methodology.

B.2. Post-registration changes

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

No temporary deviations requested

B.2.2. Corrections

No corrections requested.

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

No changes to start date requested.

B.2.4. Inclusion of monitoring plan

No monitoring plan included.

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

No permanent changes requested.

B.2.6. Changes to project design

No changes to the project design.

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

Not applicable.

SECTION C. Description of monitoring system

1) Data collection procedures

Data generation: The main meters for this project are the parshall flumes, measuring the entrance and exit of wastewater from the system. Additionally, a spectrophotometer (COD measurement), thermometers (environmental temperature measurement), a sludge flow meter and a precision scale (sludge measurement) and an electricity meter electricity consumption of the new treatment system) are used to carry out the monitoring plan. These equipments are installed, owned and maintained by Celulose Irani S.A.

Data recording: The parshall flume and the electricity meter totalize all readings of wastewater treated and electricity consumed, respectively on continuous basis. Samples of wastewater for measuring COD levels are taken from each parshall flume twice a week. The sludge flowmeter measures continuous flow. The sludge is sampled and its dry matter content is determined at least daily. Average temperature is taken daily using maximum and minimum values.

Data aggregation: Monthly totalised values are taken from parshall flumes and electricity meter. Monthly total values are taken from the dry matter of sludge. Monthly average temperature is taken from the daily readings. Monthly average COD are taken from twice-weekly readings.

Calculation: see section D.2 and section E. In summary, emission reductions are a result of the methane emissions avoided by aerobically degrading the amount of organic matter in the months with average temperature above 15°C. From this value is discounted the electricity consumed.

Reporting: The monthly data is recorded on site log sheets. At the end of each month, the monitoring data from each site is transferred to electronic files and reported to the Project Manager, which reports the same data into the Monitoring Report.

2) Organizational structure, roles and responsibilities

A CDM manager has been appointed and trained who is responsible for the CDM monitoring system. All monitored data are collected and cross checked by the Quality Assurance management sector. The Project Manager assures the quality of monitoring by adequately training the personnel involved and controlling monthly the data acquired. Relevant roles and responsibility have been defined to fully implement data collection, archiving and data quality assurance and quality control etc.

3) Emergency procedures for the monitoring system

The emergency procedures for the monitoring system consist in the following activities: Wastewater Treatment System Operator daily checks the project activity equipments and meters. If any problem occurs, the Wastewater Treatment System Responsible takes the required action to solve the problem.

4) Line diagram

The line diagram of the project, with relevant measuring points, is presented in the figure below. The parshall flumes (coupled with ultrasonic sensors) are represented by the symbol ⋈ and measures the flow of wastewater. Samples of wastewater were taken from Parshall Flumes #3 and #4 (inflow of wastewater into the system) for COD analysis. Parshall Flume #9 (outflow of wastewater from the system) is used for crosscheck of flow data (comparing en trance with exit of wastewater in the system). The electricity consumption is measured by one meter. The sludge flowmeter is represented by the symbol ⊗ and measures the volume of excess sludge that will be discarded. The sludge is also sampled for dry matter analysis in the laboratory. Temperature is taken in the company's environmental station or through national Brazilian institutes recordings.

CDM-MR-FORM

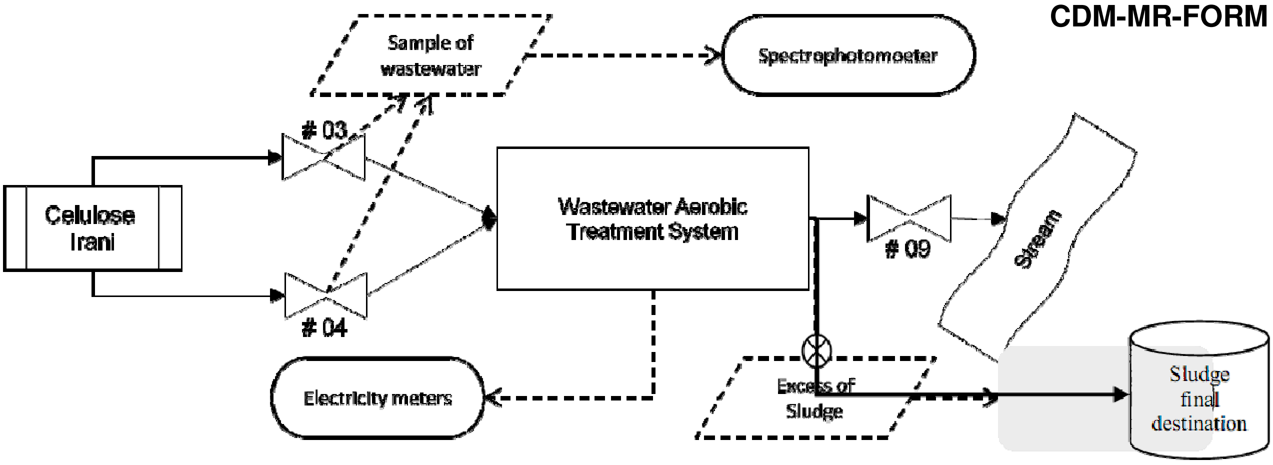

Figure – Celulose Irani Line diagram

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data / Parameter:	**B_o**
Unit:	kg CH4/kgCOD
Description:	Methane Producing Capacity (industrial wastewater)
Source of data:	IPCC 2006
Value(s) applied):	0.21
Choice of data or measurement methods and procedures	Value defined in the applicable methodology.
Purpose of data:	Baseline and Project emissions
Additional comment:	-

Data / Parameter:	**$MCF_{anaerobic,i}$**
Unit:	-
Description:	Methane Correction Factor for Anaerobic Systems
Source of data:	UNFCCC approved baseline methodology AMS III.I.
Value(s) applied):	0.8
Choice of data or measurement methods and procedures	Value defined in the applicable methodology.
Purpose of data:	Baseline emissions
Additional comment:	-

Data / Parameter:	**GWP_{CH4}**
Unit:	tCO2e/tCH_4
Description:	Methane Global Warming Potential
Source of data:	IPCC 2006
Choice of data or measurement methods and procedures	Value defined in the applicable methodology.
Value(s) applied):	25
Purpose of data:	Baseline and Project emissions
Additional comment:	-

Data / Parameter:	**UF_{PJ}**
Unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data:	UNFCCC approved baseline methodology AMS-III.I.
Value(s) applied):	1.06
Choice of data or measurement methods and procedures	Value defined in the applicable methodology.
Purpose of data:	Project emissions
Additional comment:	-

Data / Parameter:	**$MCF_{discharge,k}$**
Unit:	
Description:	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater
Source of data:	UNFCCC currently approved baseline methodology AMS-III.I.
Choice of data or measurement methods and procedures	Value suggested by the methodology
Value(s) applied):	0.1
Purpose of data:	Project emissions
Additional comment:	-

Data / Parameter:	**UF_{BL}**
Unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data:	UNFCCC approved baseline methodology AMS-III.I.
Value(s) applied):	0.94
Choice of data or measurement methods and procedures	Value suggested by the methodology
Purpose of data:	Baseline emissions
Additional comment:	-

Data / Parameter:	**$MCF_{ww,discharge,BL}$**
Unit:	
Description:	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater
Source of data:	UNFCCC currently approved baseline methodology AMS-III.I.
Choice of data or measurement methods and procedures	Value suggested by the methodology
Value(s) applied):	0.1
Purpose of data:	Project emissions
Additional comment:	-

Data / Parameter:	E_{BL}
Unit:	
Description:	Chemical Organic Demand (COD) removal efficiency from the baseline wastewater treatment system
Source of data:	Historical Value
Choice of data or measurement methods and procedures	Reference based on internal monitoring from the company for the years 2004 and 2005.
Value(s) applied):	0.6099
Purpose of data:	Project emissions
Additional comment:	-

D.2. Data and parameters monitored

Data/Parameter	COD_{in}
Unit	tonnes/m^3
Description	Monthly average Chemical Oxygen Demand entering the aerobic system.
Measured/calculated/ default	Measured
Source of data	Direct measurements from Project Developer
Value(s) of monitored parameter	2020 = 0.0024 2021 = 0.0025 2022 = 0.0030
Monitoring equipment	**Spectrophotometer:** Manufacturer: Hach Model: DR 3900 - Serial number: 1637218 Calibration frequency: 1 Year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 **Spectrophotometer:** Manufacturer: Hach Model: DR 3900 - Serial number: 1582808 Calibration frequency: 1 Year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 **Spectrophotometer:** Manufacturer: Hach Model: DR 2700 - Serial number: 1438704 Calibration frequency: 1 Year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 Both accuracy of +-1% **COD Reactor:** Manufacturer: Hach Model: DRB 200 Serial: 14110C0123 Calibration frequency: 1 year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 Accuracy: +-0.5%
Measuring/reading/recording frequency	COD analysis will be carried out twice weekly, at least.
Calculation method (if applicable)	NA

QA/QC procedures	The spectrophotometer will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure. The measuring procedures will follow recommendations by the equipment supplier and/or a documented procedure.
Purpose of data/parameter	Baseline and Project emissions
Additional comments	The measurements will take place at Celulose Irani's own laboratory, whenever possible. If not possible, a properly qualified laboratory will be used.

Data/Parameter	E_{PJ}
Unit	%
Description	Chemical Organic Demand (COD) removal efficiency from the project wastewater treatment system
Measured/calculated/ default	Calculated
Source of data	Direct measurements from Project Developer based on parameters COD_{in} and COD_{out}
Value(s) of monitored parameter	2020 = 84% 2021 = 82% 2022 = 86%
Monitoring equipment	
Measuring/reading/recording frequency	Monitoring of this specific parameter will consist of monitoring COD_{in} and COD_{out}.
Calculation method (if applicable)	-
QA/QC procedures	This parameter will not be used in ER calculations.
Purpose of data/parameter	Project emissions
Additional comments	-

Data/Parameter	COD_{out}
Unit	tonnes/m^3
Description	Monthly average Chemical Oxygen Demand exiting the aerobic system.
Measured/calculated/ default	Measured
Source of data	Direct measurements from Project Developer
Value(s) of monitored parameter	2020 = 0.0004 2021 = 0.0004 2022 = 0.0004

Monitoring equipment	**Spectrophotometer:** Manufacturer: Hach Model: DR 3900 - Serial number: 1637218 Calibration frequency: 1 Year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 **Spectrophotometer:** Manufacturer: Hach Model: DR 3900 - Serial number: 1582808 Calibration frequency: 1 Year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 **Spectrophotometer:** Manufacturer: Hach Model: DR 2700 - Serial number: 1438704 Calibration frequency: 1 Year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 Both accuracy of +-1% **COD Reactor:** Manufacturer: Hach Model: DRB 200 Serial: 14110C0123 Calibration frequency: 1 year Calibration dates: 19/03/2019; 11/03/2020; 11/05/2021 Accuracy: +-0.5%
Measuring/reading/recording frequency	COD analysis will be carried out twice weekly, at least.
Calculation method (if applicable)	NA
QA/QC procedures	The spectrophotometer will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure. The measuring procedures will follow recommendations by the equipment supplier and/or a documented procedure.
Purpose of data/parameter	Baseline and Project emissions
Additional comments	The measurements will take place at Celulose Irani's own laboratory, whenever possible. If not possible, a properly qualified laboratory will be used.

Data/Parameter	$Q_{ww,k,y}$
Unit	m3
Description	Volume of the wastewater treated by the aerobic system k during the year y
Measured/calculated/ default	Measured
Source of data	Direct measurements from Project Developer
Value(s) of monitored parameter	2020 = 397,135 2021 = 425,120 2022 = 252,899 Values monitored. The values used in calculation (adjusted due to calibration delay) can be checked in the emission reduction spreadsheet.

Monitoring equipment	**Parshall Flume coupled with ultrasonic sensor:** Manufacturer: Nivetec Model: FMU-40-ANB2A4 – Number: FT003 - Accuracy:0.5% Calibration frequency: 1 Year Calibration dates: 21/12/2018; 04/08/2020 **Parshall Flume coupled with ultrasonic sensor:** Manufacturer: Nivetec Model: FMU-40-ANB2A4 – Number: FT004 - Accuracy:0.5% Calibration frequency: 1 Year Calibration dates: 21/12/2018; 04/08/2020
Measuring/reading/recording frequency	Continuously measured.
Calculation method (if applicable)	NA
QA/QC procedures	Equipment will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data/parameter	Baseline and project emissions
Additional comments	This value refers to the full amount of wastewater exiting the project boundary, including not only the amount treated during months hotter than 15ºC but also the remaining months as well. In case of any missing data, a correspondent value from $Q_{ww,y}$ will be used.

Data/Parameter	$Q_{ww,y}$
Unit	m3
Description	Volume of the wastewater treated (discharged) during year "y"
Measured/calculated/ default	Measured
Source of data	Direct measurements from Project Developer
Value(s) of monitored parameter	2020 = 359,785 2021 = 385,752 2022 = 230,020 Values monitored. The values used in calculation (adjusted due to calibration delay) can be checked in the emission reduction spreadsheet.
Monitoring equipment	**Parshall Flume coupled with ultrasonic sensor:** Manufacturer: Nivetec Model: FMU-40-ANB2A4 – Number: FT008 - Accuracy:0.5% Calibration frequency: 1 Year Calibration dates: 15/06/2018; 02/01/2020; 01/10/2021
Measuring/reading/recording frequency	Continuously measured.
Calculation method (if applicable)	NA
QA/QC procedures	Equipment will be calibrated yearly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data/parameter	Baseline and project emissions

Additional comments	This value refers to the full amount of wastewater exiting the project boundary, including not only the amount treated during months hotter than 15ºC but also the remaining months as well. In case of any missing data, a correspondent value from $Q_{ww,y}$ will be used.

Data/Parameter	*TEMP*
Unit	Degrees Celsius
Description	Average monthly temperature
Measured/calculated/ default	Measured
Source of data	Maximum and minimum daily temperature measured, resulting in a monthly average for minimum and maximum. Monthly average temperature calculated from average minimum and average maximum.
Value(s) of monitored parameter	2020 = 18.78 2021 = 18.52 2022 = 22.60
Monitoring equipment	Third Party (INMET.GOV.BR)
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data/parameter	Baseline and Project emissions
Additional comments	For example of a trustworthy third party temperature monitoring can be mentioned the Inmet (National Institution of Meteorology): http://www.inmet.gov.br/portal/index.php?r=estacoes/estacoesautomaticas Joaçaba City Station

Data/Parameter	$COD_{ww,discharge,y}$
Unit	tonnes/m^3
Description	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in year *y*
Measured/calculated/ default	Calculated
Source of data	Calculated using direct measurements from Project Developer
Value(s) of monitored parameter	Project Emission 2020 = 0.0004 2021 = 0.0004 2022 = 0.0004 Baseline Emission 2020 = 0.0012 2021 = 0.0012 2022 = 0.0012
Monitoring equipment	Please see COD_{out} above.
Measuring/reading/recording frequency	Please see COD_{out} above.

Calculation method (if applicable)	For project emissions calculation,since the wastewater treatment system, both in baseline and project scenarios, involves a direct discharge to the river, COD_{out} and $COD_{ww,discharge,y}$ are the same. For baseline emissions calculation the outflow COD of the baseline system(s) will be estimated using the removal efficiency of the baseline treatment systems, estimated as historical records of at least one year prior to the project implementation (see Section E.1 and parameter E_{PJ} in this section).
QA/QC procedures	Please see COD_{out} above.
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	$COD_{removed,k,y}$
Unit	tonnes/m^3
Description	Chemical oxygen demand removed by the aerobic system in year *y*
Measured/calculated/ default	Calculated
Source of data	Calculated using direct measurements from Project Developer
Value(s) of monitored parameter	Project Emission 2020 = 0.0021 2021 = 0.0020 2022 = 0.0026 Baseline Emission 2020 = 0.0013 2021 = 0.0012 2022 = 0.0018
Monitoring equipment	Please see COD_{in} and COD_{out} above.
Measuring/reading/recording frequency	Please see COD_{in} and COD_{out} above.
Calculation method (if applicable)	For project emissions, the difference between COD_{in} and COD_{out} is to be applied. For baseline emissions calculation the outflow COD of the baseline system(s) will be estimated using the removal efficiency of the baseline treatment systems, estimated as historical records of at least one year prior to the project implementation (see Section E.2).
QA/QC procedures	Please see COD_{in} and COD_{out} above.
Purpose of data/parameter	Baseline and project emissions
Additional comments	

Data/Parameter	$S_{final,PJ,y}$
Unit	Tonnes
Description	Amount of sludge generated by the wastewater treatment in the monitoring period y
Measured/calculated/ default	Calculated using direct measurements
Source of data	Calculated using direct measurements from Project Developer
Value(s) of monitored parameter	2020 = 78.06 2021 = 109.32 2022 = 120.74

Monitoring equipment	**Flowmeter:** Manufacturer: Rosemount Model: 8711SHE040R5NAQ4 - Serial: 159635 - Accuracy:0.5% Calibration frequency: 2 years Calibration dates: 04/07/2018; 25/09/2020 **Flowmeter:** Manufacturer: Emerson Process Management Model: 8711SHE040RIQ4 - Serial: 14787886 - Accuracy:0.5% Calibration frequency: 2 years Calibration dates: 12/04/2018; 09/01/2020 **Precision scale:** Manufacturer: BEL Model: L1631 - Serial number: BE1600340 - Accuracy:0.01% Calibration frequency: 6 months Calibration dates: 19/08/2019; 17/02/2020; 09/09/2020; 11/03/2021; 13/09/2021 **Precision scale:** Manufacturer: Sartorius Model: BP610 - Serial number: 11407093 - Accuracy:0.01% Calibration frequency: 6 months Calibration dates: 11/03/2021; 13/09/2021
Measuring/reading/recording frequency	The volume will be monitored continuously. The dry matter content will be measured once each work shift (three times per day).
Calculation method (if applicable)	NA
QA/QC procedures	Flowmeter will be calibrated once each two years by an accredited person or institution. Precision scale will be calibrated each six months by an accredited person or institution. Both equipment have calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data/parameter	Project emissions.
Additional comments	Since methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled combusted, the end-use of the final sludge will be monitored during the crediting period. If any other use of sludge is applied, it will be dealt with according to the methodology. This parameter was not estimated because it is not needed for emission calculations in the present scenario.

Data/Parameter	EC_y
Unit	MWh
Description	Electricity consumed by the project activity devices in the monitoring period y
Measured/calculated/ default	Measured
Source of data	Direct measurements from Project Developer
Value(s) of monitored parameter	2020 = 5,492.50 2021 = 6,058.83 2022 = 315.04 The values used in calculation (adjusted due to calibration delay) can be checked in the emission reduction spreadsheet.

Monitoring equipment	**Electricity meter:** Manufacturer: Allen-Bradley Model: 1000 - Serial number: 40826282 Accuracy class: ±0.5% (in % of Full Scale at +25 °C 50/60 Hz Unity Power Factor) Calibration frequency: 3 years Calibrations dates: 21/10/2016; 27/05/2020 **Electricity meter:** Manufacturer: Allen-Bradley Model: 3000 - Serial number: 1404-M405A-RIO Accuracy class: ANSI C12.20 Class 0.5 Calibration frequency: 3 years Calibrations dates: 19/09/2019; 15/07/2020
Measuring/reading/recording frequency	Continuously measured.
Calculation method (if applicable)	NA
QA/QC procedures	Meters will be calibrated once each three years by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data/parameter	Project emissions.
Additional comments	In case measurements cannot be performed, the theoretical maximum consumption is used, according to the installed capacity of the equipment and a theoretical load factor.

Data/Parameter	$MCF_{aerobic,k}$
Unit	-
Description	Methane Correction Factor for the aerobic wastewater treatment system
Measured/calculated/ default	Default
Source of data	UNFCCC currently approved baseline methodology AMS-III.I.
Value(s) of monitored parameter	2020 = 0.0 2021 = 0.0 2022 = 0.0 Although only values equal to 0.0 and 0.3 are possible (monthly values), the values reported above correspond to annual average.
Monitoring equipment	-
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	NA
QA/QC procedures	All equipment involved will be maintained according to the manufacturer's recommendations and will be calibrated regularly by an accredited person or institution, with calibration schedule following Celulose Irani's maintenance procedure.
Purpose of data/parameter	Project emissions

Additional comments	Since a MCF value of zero is adopted for the project wastewater treatment system assuming that it is a well-managed aerobic system, its operation will be documented in a quality control program. Therefore, the operating conditions of the treatment system will be monitored to verify if they are within the specified range so as to ensure the aerobic condition of the reactors. The acceptable range of operational parameters are defined for continuous aerobic operation of the treatment system in accordance with the engineering design of the wastewater treatment system and reported in the PDD. The operational parameters are then continuously monitored to ensure that they are always kept in the design range of operating conditions. In case the operational parameters are not within the limits for a period of time, a MCF value of 0.3 shall be taken for that period.

Data/Parameter	$EF_{grid,CM,y}$
Unit	tCO_2e/MWh
Description	Grid emission factor
Measured/calculated/ default	Calculated
Source of data	Brazilian DNA
Value(s) of monitored parameter	2020 = 0.2375 2021 = 0.2375 2022 = 0.2441
Monitoring equipment	NA
Measuring/reading/recording frequency	Continuous
Calculation method (if applicable)	The Brazilian Designated National Agency (DNA) performs all calculation related to the Brazilian Electricity Grid (*Sistema Interligado Nacional* – SIN) and demands all CDM projects to use this number. This entity provides an Operational Margin (OM) and a Build Margin (BM), and the Combined Margin (CM) is calculated accordingly.
QA/QC procedures	The Brazilian DNA is the responsible for the information.
Purpose of data/parameter	Project emissions
Additional comments	-

D.3. Implementation of sampling plan

There is no need for implementing a formal sampling plan to this project

SECTION E. Calculation of emission reductions or net anthropogenic removals

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

$$BE_y = BE_{ww,treatment,y} + BE_{ww,discharge,y} + BE_{s,treatment,y} + BE_{s,final,y} \quad (1)$$

Where:

BE_y Baseline emissions in the year *y* (tCO_2e)

$BE_{ww,treatment,y}$	Methane produced in the anaerobic baseline wastewater treatment system(s) that is/are being replaced with the biological aerobic system(s) (tCO_2e)
$BE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc. (tCO_2e)
$BE_{s,treatment,y}$	Methane produced in the baseline sludge treatment system(s) (tCO_2e) – **not applicable**
$BE_{s,final,y}$	Baseline methane emissions from anaerobic decay of the final sludge produced (tCO_2e) – **not applicable**

The baseline emissions from the anaerobic wastewater treatment system(s) are estimated as follows:

$$BE_{ww,treatment,y} = \sum_{i,m} \left(Q_{ww,m,y} * COD_{removed,i,m,y} * MCF_{anaerobic,i} \right) * B_o * UF_{BL} * GWP_{CH4} \quad \textbf{(2)}$$

Where:

$Q_{ww,m,y}$	Volume of the wastewater treated during the months m, during year *y*, for the months with ambient average temperature above 15°C (m^3)
i	Index for baseline wastewater treatment system
$MCF_{anaerobic,i}$	Methane correction factor for the anaerobic baseline wastewater treatment system *i* replaced by the project activity, value as per table III.I.1
$COD_{removed,i,m,y}$	Chemical oxygen demand removed by the anaerobic wastewater treatment system *i* in the baseline situation in the year *y* for the months *m* with ambient average temperature above 15° C (tonnes/m^3)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[1]
B_o	Methane producing capacity for the wastewater (IPCC default value of 0.21 kg CH_4/kg COD)[2]
GWP_{CH4}	Global Warming Potential for CH_4 (value of 21)

Methane emissions from degradable organic carbon in treated wastewater discharged in e.g., a river, sea or lake are determined as follows:

$$BE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_o * UF_{BL} * COD_{ww,discharge,BL,y} * MCF_{ww,discharge,BL} \quad \textbf{(3)}$$

Where:

$Q_{ww,y}$	Volume of treated wastewater discharged in year *y* (m^3)
UF_{BL}	Model correction factor to account for model uncertainties (0.94)[3]
$COD_{ww,discharge,BL,y}$	Chemical oxygen demand of the treated wastewater discharged into sea, river or lake in the baseline situation in year *y* (tonnes/m^3)
$MCF_{ww,discharge,BL}$	Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater (fraction)

---

[1] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[2] The IPCC default value of 0.25 kg CH_4/kg COD was corrected to take into account the uncertainties. Project activities may use the default value of 0.6 kg CH4/kg BOD, in case the parameter $BOD_{5,20}$ is used to determine the organic content of the wastewater. In this case the monitoring shall be based in direct measurements of $BOD_{5,20}$, i.e., the estimation of BOD values based on COD measurements is not allowed.

[3] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

The MCF value used is for anaerobic lagoons deeper than 2 meters.
In the determination of baseline emissions, historical records of two years prior to the project implementation are used (2004 and 2005). The outflow COD and COD removed by the baseline system shall be based on the removal efficiency of the baseline system estimated using this 2-year period data (2013 and 2014). Sludge will not be landfilled in the project scenario.

Calculation of baseline emissions	Symbol	Value	Unit	Formula
Volume of the wastewater treated by the aerobic system k during the year y with average lagoon temperature above 15°C	$Q_{ww,k,y}$	on Section D.2	m^3	Direct measurements
Chemical oxygen demand removed by the anaerobic wastewater treatment system i in the baseline situation in the year y for the months m with ambient average temperature above 15° C	$COD_{removed,i,m,y}$	on Section D.2	$tonnes/m^3$	project inflow COD * baseline COD removal efficiency (based on 2004 and 2005 years, efficiency of 60.99%)
Methane correction factor for the anaerobic baseline wastewater treatment system i replaced by the project activity	$MCF_{anaerobic,i}$	0.8	%	Default value
Model correction factor to account for model uncertainties	UF_{BL}	0.94	%	Default value
Methane producing capacity for the wastewater	B_o	0.21	$tCH_4/tCOD$	Default value
Global Warming Potential for CH4	GWP_{CH4}	25	tCO_2e/tCH_4	Default value
The baseline emissions from the anaerobic wastewater treatment system	**$BE_{ww,treatment,y}$**	**2020= 23,878 2021= 25,183 2022= 1,834**	**tCO_2e**	**$\Sigma (Q_{ww,y}*COD_{removed,i,m}*MCF_{anaerobic,i})*B_0*UF_{BL}*GWP_{CH4}$**
Volume of treated wastewater discharged in year y	$Q_{ww,y}$	On Section D.2	m^3	Direct measurements
Baseline chemical oxygen demand of the final treated wastewater discharged into river	$COD_{ww,discharged,BL,y}$	on Section D.2 Baseline Emission values	$tonnes/m^3$	difference of inflow COD_{in} and the removed $COD_{removed}$[4]
Methane correction factor based on the discharge pathway (river) of the wastewater (fraction)	$MCF_{ww,discharge,BL}$	0.1	%	Default value
	$BE_{ww,discharge,y}$	**2020= 2,517 2021= 2,784**	**tCO_2e**	**$Q_{ww,y}*GWP_{CH4}*B_0*UF_{BL}*COD_{ww,discharge,BL,y}*MCF_{ww,discharge,BL}$**

[4] the monitored values of the COD_{in} inflow during crediting period were used to calculate the baseline emissions *ex post*. The outflow $COD_{removed}$ of the baseline systems was estimated using the removal efficiency of the baseline treatment systems (COD removal efficiency equal to 60.99%).

		2022= 133		
Total Baseline emissions	**BEy**	**2020= 26,396 2021= 27,968 2022= 1,967 Total= 56,331**	**tCO_2e**	**$BE_{ww,treatment,y} + BE_{ww,discharge,y}$**

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

Project activity emissions consists of:

(i) CO_2 emissions related to the power and fossil fuel used by the project activity facilities ($PE_{power,y}$);

(ii) Methane emissions during the treatment of the wastewater in biological aerobic wastewater treatment systems ($PE_{ww,treatment,y}$);

(iii) Methane emissions from degradable organic carbon in treated wastewater discharged in sea/river or lake ($PE_{ww,discharge,y}$);

(iv) Methane emissions from sludge treatment in the project activity ($PE_{s,l,y}$);

(v) Methane emissions from the decay of the final sludge generated by the project activity, if the sludge is disposed to decay anaerobically in a landfill without methane recovery ($PE_{s,final,y}$).

$$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{ww,discharge,y} + PE_{s,treatment,y} + PE_{s,final,y} \quad \textbf{(4)}$$

Where:

PE_y	Project activity emissions in year y (tCO_2e)
$PE_{power,y}$	Emissions on account of electricity or fossil fuel consumption in the year y (tCO_2e)
$PE_{ww,treatment,y}$	Methane emissions from the biological aerobic wastewater treatment in the year y (tCO_2e)
$PE_{ww,discharge,y}$	Methane emissions on account of inefficiencies in the project wastewater treatment systems and presence of degradable organic carbon in the treated wastewater discharged into river/lake/sea etc. (tCO_2e)
$PE_{s,final,y}$	Methane emissions from anaerobic decay of the final sludge produced in year y (tCO_2e) **– not applicable**
$PE_{s,treatment,y}$	Methane produced in the project sludge treatment system(s) (tCO_2e)

Project activity emissions from electricity and fossil fuel consumption ($PE_{power,y}$) are determined as per the procedures described in AMS-I.D. The energy consumption of all equipment/devices installed by the project activity, *inter alia* all equipment to treat wastewater and sludge shall be included. For project activity emissions from fossil fuel consumption the emission factor for the fossil fuel shall be used (tCO_2/tonne). Local values are to be used, if local values are difficult to obtain, IPCC default values may be used. If recovered methane is used to power auxiliary equipment of the project it should be taken into account accordingly, using zero as its emission factor.

Methane emissions during the biological aerobic treatment of wastewater are determined as follows ($PE_{ww,treatment,y}$):

$$PE_{ww,treatment,y} = \sum_k \left(Q_{ww,k,y} * COD_{removed,k,y} * MCF_{aerobic,k}\right) * B_o * UF_{PJ} * GWP_{CH4} \quad \textbf{(5)}$$

Where:

$Q_{ww,k,y}$	Volume of the wastewater treated by the aerobic system *k* during the year *y* (m^3)
k	Index for project wastewater treatment system
$COD_{removed,k,y}$	Chemical oxygen demand removed by the aerobic system *k* in year *y* ($tonnes/m^3$)
$MCF_{aerobic,k}$	Methane correction factor for the aerobic wastewater treatment system *k* (MCF value for well managed aerobic biological systems, or for poorly managed or overloaded systems as per table III.I.1 shall be taken)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)[5]

Methane emissions from degradable organic carbon in treated wastewater discharged in sea/river or lake in the project situation are determined as follows ($PE_{ww,discharge,y}$):

$$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_o * UF_{PJ} * COD_{ww,discharge,y} * MCF_{ww,discharge} \quad \textbf{(6)}$$

Where:

$Q_{ww,y}$	Volume of wastewater treated in the year *y* (m^3)
$COD_{ww,discharge,y}$	Chemical oxygen demand of the final treated wastewater discharged into sea, river or lake in the year *y* ($tonnes/m^3$)
$MCF_{ww,discharge}$	Methane correction factor based on discharge pathway of the wastewater (fraction) (MCF value in table III.I.1 for sea, river and lake discharge)
UF_{PJ}	Model correction factor to account for model uncertainties (1.06)[6]

Methane emissions from the project sludge treatment systems *l* are determined as follows:

$$PE_{s,treatment,y} = \sum_{l} S_{l,PJ,y} * MCF_{s,treatment,l} * DOC_s * UF_{PJ} * DOC_F * F * 16/12 * GWP_{CH4} \quad \textbf{(7)}$$

Where:

$S_{l,PJ,y}$	Amount of dry matter in the sludge treated by the sludge treatment system *l* in year *y* (tonne)
l	Index for project sludge treatment system

In case sludge is composted, the following equation shall be applied:

$$PE_{s,treatment,y} = \sum_{l} S_{l,PJ,y} * EF_{composting} * GWP_{CH4} \quad \textbf{(8)}$$

Where:

$EF_{composting}$	Emission factor for composting of organic waste (t CH_4/ton waste treated). Emission factors can be based on facility/site-specific measurements, country specific values or IPCC default values (table 4.1, chapter 4, Volume 5, 2006 IPCC Guidelines for National Greenhouse Gas Inventories). IPCC default value is 0.01 t CH_4/t sludge treated on a dry weight basis.

$PEy = PE_{y,power} + PE_{y,ww,treatment} + PE_{ww,discharge,y} + PE_{s,treatment,y}$

[5] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

[6] Reference: FCCC/SBSTA/2003/10/Add.2, page 25.

Calculation of project emissions	Symbol	Value	Unit	Formula
Volume of the wastewater treated by the aerobic system k during the year y with average lagoon temperature above 15°C	$Q_{ww,k,y}$	on Section D.2	m^3	Direct measurements
Chemical oxygen demand removed by the aerobic system k in year y	$COD_{removed,k,y}$	on Section D.2	tonnes/m^3	Calculated (difference of inflow COD and the outflow COD)
Methane correction factor for the wastewater treatment in anaerobic lagoons	$MCF_{aerobic,k}$	0 or 0.3	-	Default value
Methane producing capacity for the wastewater	B_o	0.21	tCH4/tCOD	Default value
Model correction factor to account for model uncertainties	UF_{PJ}	1.06	%	Default value
Global Warming Potential for CH4	GWP_CH_4	25	tCO_2e/tCH_4	Default value
Project emissions from Aerobic Treatment	**$PE_{ww,treatment}$**	2020= 0 2021= 1,991 2022= 0 Total= **1,991**	**tCO2e**	**$\sum k(Q_{ww,k} * COD_{removed,k} * MCF_{aerobic,k}) * B0 * UF_{PJ} * GWP_{CH4}$**
Electricity consumption	ECy	20,929.24	MWh	Monitored
Combined Grid Emission Factor	$EF_{grid,CM}$	on Section D.2	tCO2e/MWh	Ex post value
Project emissions from electricity consumption	**PE_{power}**	2020= 1,305 2021= 1,437 2022= 77 Total= **2,819**	**tCO2e**	**$ECy * EF_{grid,CM}$**
Chemical oxygen demand of the final treated wastewater discharged into river	$COD_{ww,discharge}$	on Section D.2 (Project Emissions values)	tonnes/m^3	Direct measurements (equal to outflow COD)
Methane correction factor based on the discharge pathway (e.g., into sea, river or lake) of the wastewater	$MCF_{ww,discharge,k}$	0.1	**%**	Default value
Project emission from Methane emissions on account of inefficiencies in the project wastewater treatment systems	**$PE_{ww,Discharge}$**	2020= 905 2021= 1,111 2022= 55 Total= **2,071**	**tCO2e**	**$Qww * GWP_{CH4} * B_0 * UF_{PJ} * COD_{ww,discharge} * MCF_{ww,discharge}$**
Project emissions from composting	**$PE_{s,treatment,y}$**	2020= 234 2021= 328	**tCO2e**	**$\sum SI,PJ,y$ *EFcompostting * $GWPCH_4$**

		2022= 30 Total= **592**		
Total Project emissions	**PEy**	2020= 2,444 2021= 4,867 2022= 162 Total= **7,473**	**tCO2e**	$PE_{y,power} + PE_{y,ww,treatment} + PE_{ww,discharge,y}$

Leakage

If the aerobic treatment technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage effects at the site of the other activity are to be considered.

The equipment for the aerobic treatment system is not transferred from another facility and the existing equipment will not be transferred to another activity, therefore, leakage effects are not considered.

Emission Reductions

The emission reduction achieved by the project activity will be calculated as the difference between the baseline emission and the sum of the project emission and leakage.

$$ER_y = BE_y - (PE_y + LE_y) \quad \textbf{(9)}$$

Where:

ER_y Emission reduction in the year *y* (tCO_2e)

LE_y Leakage emission in the year *y* (tCO_2e)

Since $LE_y = 0$ so:

$ER_y = BE_y – PE_y$

ER_{2020} = 23,952 tCO_2e
ER_{2021} = 23,101 tCO_2e
ER_{2022} = 1,805 tCO_2e

E.3. Calculation of leakage emissions

According to the PDD and methodology, leakage emission calculations are not applicable to the Project Activity.

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

	Baseline GHG emissions or	**Project GHG emissions or actual net**	**Leakage GHG emissions**	**GHG emission reductions or net anthropogenic GHG removals ($t CO_2e$)**

				Before 01/01/2013	From 01/01/2013 until 31/12/2020	From 01/01/2021	Total amount
Total	56,331	7,473	0	0	23,952	24,906	48,858

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)
48,858	97,815

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

>>Since the period covered by this monitoring report is between 01/01/2020 until 18/01/2022 the number of days enclosed are 749.

Since was forecasted *ex ante* a quantity of 47,667 tCO_2e per 365 days, it results in 131 tCO_2e per day.
So for 749 days was expected, *ex ante*, a total of 97,815 tCO_2e.

E.6. Remarks on increase in achieved emission reductions

The emission reductions over the monitoring period are lower than forecasted in the PDD.

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

>>During all the monitored years the measures were limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

On see Section E.2:

ER_{2020} = 23,952 tCO_2e
ER_{2021} = 23,101 tCO_2e
ER_{2022} = 1,805 tCO_2e

Document information

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

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

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
Keywords: monitoring report