



**Verification and certification report form for
CDM project activities
(Version 04.0)**

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

BASIC INFORMATION

Title and UNFCCC reference number of the project activity	Introduction of the recovery and combustion of methane in the existing sludge treatment system of the Cañaveralajo Wastewater Treatment Plant of EMCALI in Cali, Colombia UNFCCC ref. #: 2341		
Scale of the project activity	<input type="checkbox"/> Large-scale <input checked="" type="checkbox"/> Small-scale		
Version number of the verification and certification report	1		
Completion date of the verification and certification report	18/11/2021		
Monitoring period number and duration of this monitoring period	2 nd Monitoring period 01/11/2012 to 31/12/2015 (both days included)		
Version number of the monitoring report to which this report applies	02.3		
Crediting period of the project activity corresponding to this monitoring period	Type: fixed Start date: 14/09/2010, Length: 10 years		
Project participants	Empresas Municipales de Cali EMCALI-EICE ESP ALLCOT AG		
Host Party	Colombia		
Applied methodologies and standardized baselines	AMS-III.H. ver. 09.0 - Methane recovery in wastewater treatment		
Mandatory sectoral scopes	- 13 : Waste handling and disposal		
Conditional sectoral scopes, if applicable	- 1: Energy industries (renewable - / non-renewable sources)		
Estimated amount of GHG emission reductions or GHG removals for this monitoring duration in the registered PDD	186,648 tCO ₂ e		
Certified amount of GHG emission reductions or GHG removals for this monitoring period	Amount before 1 January 2013	Amount from 1 January 2013 until 31 December 2020	Amount from 1 January 2021
	4,779 tCO ₂ e	142,288 tCO ₂ e	0 tCO ₂ e
Name and UNFCCC reference number of the DOE	Earthood Services Private Limited (ESPL) (ref E- 0066)		

Name, position and signature of the approver
of the verification and certification report



Dr. Kaviraj Singh
Managing Director

SECTION A. Executive summary

Brief summary of the project activity

The project activity corresponds to an introduction of a methane recovering system in an existing anaerobic sludge treatment system in wastewaters (Wastewater Treatment Plant – WWTP Cañaveralejo). The Baseline emissions will be generated by destruction of this methane either in flare, water heater or electricity generators. Baseline due to the renewable energy generation is not part of in this project activity.

The project activity is small scale type III as it generates less than 60k tCO₂e/y.

The project activity is located in Cali, Colombia.

Scope of verification

ALLCOT AG has contracted Earthood Services Private Limited to conduct the verification and certification of emission reductions reported for the CDM project activity “Introduction of the recovery and combustion of methane in the existing sludge treatment system of the Cañaveralejo Wastewater Treatment Plant of EMCALI in Cali, Colombia” for the period from 01/11/2012 to 31/12/2015 (including both days).

The verification is the periodic independent review and ex-post determination of the monitored reductions in GHG emissions that have occurred due to the registered CDM project activity during the defined monitoring period.

The scope of the verification is to establish/verify that:

- the project activity has been implemented and operated as per the registered PDD or any approved revised PDD, and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- the monitoring report and other supporting documents provided are complete in accordance with the latest applicable version of the completeness checklist for requests for issuance of CERs, verifiable, and in accordance with applicable CDM requirements;
- the actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan, any revised approved monitoring plan, the approved methodology including applicable tool(s) and/or, where applicable, the approved standardized baseline;
- the data recorded and stored as per the monitoring methodology including applicable tool(s) and, where applicable, the standardized baseline.

Verification process

The verification process involved following:

- Contract with ALLCOT AG for the scope of verification;
- publication of monitoring report;
- desk review;
- physical on-site inspection;
- issuance of verification findings;
- reporting, calculation checks, QA/QC and resolution of findings;
- issuance of draft verification report;
- independent technical review of the project documentation;
- issuance of the final verification report;
- submission of the request for issuance, as appropriate.

Conclusion

Earthood Services Private Limited has performed the verification of the CDM PA “Introduction of the recovery and combustion of methane in the existing sludge treatment system of the Cañaveralejo Wastewater Treatment Plant of EMCALI in Cali, Colombia”, having UNFCCC Ref. Number 2341 for the period from 01/11/2012 to 31/12/2015. The verification team has confirmed the implementation of the project as per description in the revised PDD, the monitoring plan of the PDD and the application of the monitoring methodology (AMS-III.H ver 09.0). In addition, it was confirmed that the monitoring system is in place and the emission reductions are calculated without material misstatements.

The verified emission reductions amount to 147,067 tCO₂e in the above mentioned monitoring period.

The verification team concluded that the registered CDM PA complies with all relevant CDM procedures/standards/guidance and therefore request for issuance is being submitted in accordance with the CDM procedures.

SECTION B. Verification team, technical reviewer and approver

B.1. Verification team member

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interviews	Verification findings
1.	Team Leader	OR	Sebben	Marcelo	Verifit	Y	N	Y	Y
2.	Technical Expert	OR	Sebben	Marcelo	Verifit	Y	N	N	Y
3	Methodological Expert	OR	Lopes	Ricardo	Verifit	Y	N	N	Y
4	Local Expert	EI	Grisales	Cristian	Central Office	Y	Y	Y	Y

B.2. Technical reviewer and approver of the verification and certification report

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical reviewer	IR	Gautam	Ashok	Central Office
2	Technical Expert	IR	Gautam	Ashok	Central Office
3	Approver	IR	Singh	Kaviraj	Central Office

SECTION C. Application of materiality

C.1. Consideration of materiality in planning the verification

No.	Risk that could lead to material errors, omissions or misstatements	Assessment of the risk		Response to the risk in the verification plan and/or sampling plan
		Risk level	Justification	
1.	<i>Human error in recording the readings</i>	<i>Low</i>	<i>All parameters are measured on-line, therefore reducing the chance of error</i>	<i>Double check the raw data and compare it with data provided in the ER calculations.</i>
2.	<i>Error in transferring the data to ER sheet</i>	<i>Medium</i>	<i>Transfer of data from source to ER calculation involve human intervention and might lead to inconsistencies.</i>	<i>The values reported in ER sheet to be checked with their respective source data. The values for all parameters reported at the interval of were verified from the source data.</i>
3.	<i>Calculation of parameters</i>	<i>Low</i>	<i>Human errors entering formulas and data.</i>	<i>All formulas are checked and compared to applied methodology and tools. In addition, entry data are crosschecked with raw data.</i>

C.2. Consideration of materiality in conducting the verification

Not applicable as 100% of data was checked. To all errors, misstatements or omissions found in the description or calculations, findings were raised and duly closed. Therefore, the validation team confirms that the verification is free of material errors, omissions or misstatements at a reasonable level.

SECTION D. Means of verification

D.1. Desk/document review

A desk review was conducted by the verification team that included:

- a review of the data and information presented to verify its completeness;
- a review of the registered monitoring plan, the monitoring methodology including applicable tool(s) and, where applicable, the applied standardized baseline, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;
- an evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

A complete list of documents/evidences reviewed is included as Appendix 3.

D.2. On-site inspection

Duration of on-site inspection: 15/07/2021 to 16/07/2021				
No.	Activity performed on-site	Site location	Date	Team member
1.	Opening Meeting: Introduction, scope and objective of work, roles and responsibilities of audit team, resources required, and timetable of the onsite audit including venue for closing meeting and any concerns from PP.	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales Marcelo Sebben (virtual means)
2.	Monitoring procedures Applicability of legislation (environmental and operational licenses)	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales
3.	Physical inspection of the project activity: Site visit and interview of monitoring personnel Places visited <ul style="list-style-type: none"> - WWTP-C – and electricity consumption meter - Sedimentation tanks - Digestion tanks - Transference of biogas from digestion tanks - biogas piping to flare (flow and composition meters and temperature meters) - Engines - Water heater 	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales
4.	Verification of equipment that consume electricity Verification of installed equipment for parameters measurement: <ul style="list-style-type: none"> - Gas Analyser (CH₄ – fv_{CH₄,FV,h}) to the system - Biogas flow meter (parameter FV_{RG,h} to the system) - Termocouple Flare 1 - Termocouple Flare 2 - Biogas flow meter to Genset 1 (parameter FV_{G1,h}) - Biogas flow meter to Genset 2 (parameter FV_{G2,h}) - Biogas flow meter to water heater (parameter FV_{H,h}) - Gas analyser (CH₄ composition – fv_{CH₄,H,h}) in water heater - Gas analyser (CH₄ composition – fv_{CH₄,G,h}) in gensets 1 and 2. 	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales
5.	Verification of system raw data (SCADA) and download directly from company system of following periods <ul style="list-style-type: none"> - 01/11/2012 hasta 31/12/2015 - 01/01/2016 hasta 31/12/2019 Screen shots from internal systems (check which parameters are available in the internal system)	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales (On site)

6.	Training of operating personnel	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales
7.	Closing Meeting at on-site visit with deliver of preliminary findings	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	15/07/2021	Cristian Grisales Marcelo Sebben (Virtual means)
8.	Compilation of downloaded Scada raw data and comparison with calculation ER spreadsheet	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	16/07/2021	Marcelo Sebben
9.	Review of ER calculations in accordance with applied methodology and relevant tools.	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	16/07/2021	Marcelo Sebben
10.	Closing Meeting: Submission of the audit findings to the client and agreement on the issues raised and agreement on timelines	Wastewater Treatment Plant, Cañaveralejo, (WWTP-C)	16/07/2021	Marcelo Sebben

The on-site inspection was not conducted by the team leader during this verification process due to the COVID-19 pandemic. Instead, the OSV was conducted by a local expert. The alternative means of conducting this audit process have been considered in accordance with Board recommendation that allows for the period between 23 March to 31 December 2021.

The team leader could not participate of the on-site inspection physically due to travel restrictions from Brazil to Colombia. Moreover, the site inspection could not be postponed as the PP has signed an ERPA for commercializing the CERs. All evidences were duly provided^{/21/} and the assessment for the applicability of the Board recommendation is kept in the DOE database.

In order to carry out the verification process, the DOE used other standard auditing techniques for verification, as referred to in sections 7.1.3 and 9.1.3 of the VVS-PA as follows:

- Site inspection conducted by local expert
- Current pictures of main equipment^{/14/}.
- Document review

These audit techniques used have been considered sufficient and credible by the verification team for the purpose of the present verification.

D.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Garcia	Mario	EMCALI	15/07/2021	<ul style="list-style-type: none"> - Applicable legislation - Physical inspection - Training of operational personnel 	Cristian Grisales
2.	Mora	Luz	EMCALI	15/07/2021	<ul style="list-style-type: none"> - Physical inspection 	Cristian Grisales
3.	Valencia	Orlando	EMCALI	15/07/2021	<ul style="list-style-type: none"> - Verification of system raw data (SCADA) 	Cristian Grisales
4.	Madrid	Rodolfo	EMCALI	15/07/2021	<ul style="list-style-type: none"> - Verification of installed equipment 	Cristian Grisales
5.	Otero	Luz Angela	EMCALI	15/07/2021	<ul style="list-style-type: none"> - Applicable legislation 	Cristian Grisales
6.	Sanchez	Martha	EMCALI	15/07/2021	<ul style="list-style-type: none"> - Monitoring procedure 	Cristian Grisales
7.	Gil	Alfredo	ALLCOT	16/07/2021	<ul style="list-style-type: none"> - Review of ER calculations - CDM aspects - MR description 	Marcelo Sebben

D.4. Sampling approach

Not applicable as no sampling has been used during the verification.

D.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Areas of verification findings	No. of CL	No. of CAR	No. of FAR
Compliance of the monitoring report with the monitoring report form	CL 01	-	-
Compliance of the project implementation and operation with the registered PDD	CL 02	-	-
Post-registration changes	CL 03	-	-
Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines	-	-	-
Compliance of monitoring activities with the registered monitoring plan	CL 06	CAR 01	-
Compliance with the calibration frequency requirements for measuring instruments	-	CAR 02	-
Assessment of data and calculation of emission reductions or net removals	CL 04 CL 05	CAR 03 CAR 04	-
Assessment of reported sustainable development co-benefits	-	-	-
Global stakeholder consultation	-	-	-
Others (please specify)	-	-	-
Total	6	4	-

SECTION E. Verification findings

E.1. Compliance of the monitoring report with the monitoring report form

Means of verification	The MR was crosschecked with the CDM-MR-FORM template available at the UNFCCC website and with the instructions for filling it out. It has been observed that not the most recent version of the MR template has been used. Therefore a CL has been raised.
Findings	CL 01 The template version of the CDM-MR-FORM applied is not the latest version available.
Conclusion	A valid version of the verification template (CDM-MR-FORM – version 09.0) available at the UNFCCC website has now been used. All sections were completed in accordance with instructions for completing the MR.

E.2. Remaining forward action requests from validation and/or previous verifications

Means of verification	The latest verification report ^{/11/} has been reviewed and it was observed that no FAR was open during the previous verification phase.
Findings	N/A
Conclusion	No FAR has been raised in the previous monitoring period.

E.3. Compliance of the project implementation and operation with the registered project design document

Means of verification	<p>During the on-site visit, the verification team checked the implementation status of the project activity as well as the monitoring equipment. In addition, interviews with personnel and PP's representatives were also performed.</p> <p>The project activity corresponds to an introduction of a methane recovering system in an existing anaerobic sludge treatment system in wastewaters (Wastewater Treatment Plant – WWTP Cañaveralejo).</p> <p>It has been duly mentioned in the MR that the construction of the WWTP Cañaveralejo has started on 1997 and has been operationalized in 2002. Apart from that, it has been stated the contracts for installing the instruments for implementing the project activity have been signed only on 26/08/2010^{/24/} and therefore, the start date of crediting period has been transferred to 14/09/2010 as it was the forecasted date for implementation of all equipment of the project activity. The delay of start date of CP has been requested and approved prior to this verification process. It was also noted that the effective monitoring of project activity started only on 13/01/2011 (see 1st monitoring report¹). However this delay only affected the 1st monitoring period and did not affect this one.</p> <p>The operation of the project activity has been observed during the site visit and checked through interviews performed to the plant operators. At the on-site inspection, it has been observed that the PA is operated by collecting the biogas from the anaerobic sludge treatment system and through piping it is compressed to a gas storage tank. From this storage tank, the biogas is then forwarded to the gas engines to generate electricity. Alternatively, in case the engines are not operative, the biogas is diverted either to flare or to water heater to be destroyed. All meters used to monitor the monitoring parameters are duly installed as per monitoring plan. In the baseline scenario, the biogas would be released to atmosphere.</p> <p>The Baseline emissions were generated by destruction of this methane either in flare, water heater or electricity generators. Baseline due to the renewable energy generation <u>is not</u> part of in this project activity.</p> <p>Moreover, the project activity does not claim emission reductions from heat generation.</p>
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¹ <https://cdm.unfccc.int/Projects/DB/RINA1228922788.48/iProcess/ICONTEC1408455919.93/view>

	<p>The project is located in the Wastewater Treatment Plant – WWTP Cañaveralejo, located in Cali, Colombia. The geographical coordinates are the following, which could be duly checked on Google Maps^{/16/}:</p> <p>Latitude: 3°28'10.06538" North</p> <p>Longitude: 76°28'44.03571" West</p> <p>The project activity is small scale type III as it generates less than 60k tCO₂e/y.</p> <p>The following main equipment is installed:</p> <p><u>Gas storage tanks</u></p> <ul style="list-style-type: none"> - Quantity: 2 - Volume: 1,000 m³ - Diameter: 12.451 m - Height: 13 m <p><u>Gas engine generator</u></p> <ul style="list-style-type: none"> - Manufacturer: Waukesha - Type: Engine with the gas pre-chamber, 4 strokes, 4 valves - Quantity: 2 - S/N: C-80750/1 and C-80750/2 - Nominal Capacity: 1026 KW each - Operation: Automatic with output power and manual switch - Cylinder no.: V-12 - Speed: 1,200rpm. - Fuel consumption: 2,651 Mcal/hr of biogas <p><u>Enclosed Flare</u></p> <ul style="list-style-type: none"> - Manufacturer: 3Ts International Ltda - Model: FL550 - Quantity: 2 - Power: 2.2 kW (gas booster) +1.1 kW (ventilator) - Operation: Automatic with the level of biogas in the storage gas tank - Flow: 550m³/h <p><u>Water heater</u></p> <ul style="list-style-type: none"> - Type: 3 lines - Quantity: 1 - Capacity: 1,200 Mcal/h - Power: 2.5 kW (gas booster) - 7.5 kW (ventilator) <p>Nevertheless, as required by VVS paragraph 319f) the DOE shall review the compliance of the PA with national regulations. It is not clear, though, the compliance of the PA with Colombian Resolution 1447/2018^{/13-2/}, therefore a CL has been raised.</p>
Findings	<p>CL 02</p> <p>It is not clear whether the project activity is complying with the requirements of Colombian Resolution 1447/2018, regarding the registration of the initiative under National GHG Emission Reduction Platform (RENARE)</p>
Conclusion	<p>According to information verified during the site visit, the verification team has confirmed that all physical features (technology, project equipment, and monitoring and metering equipment) of the PA were in place and are in accordance with the registered PDD.</p> <p>These physical features comprise^{/14/}:</p> <ul style="list-style-type: none"> - WWTP-C – (Wastewater Treatment Plant) - 8 Sedimentation tanks - 2 Gas storage tanks - 2 Gas engine generator - 2 Enclosed Gas flare - 1 water heater

	<p>The PA remains within the small scale threshold (ERs <60k tCO₂e/year)</p> <p>The project activity is complying with all applicable National legislation^{13/}, it is now duly registered in the platform RENARE^{23/} according to the requirements of National legislation (Colombian Resolution 1447/2018) and therefore the project is now fulfilling this requirement.</p> <p>The plant was operated as per as the current valid version of PDD. The detailed operation of the project activity has been described in the means of verification above in this section. The MR describes the correct implementation and start date of operation of this project activity as required by Project Standard.</p>
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E.4. Post-registration changes

E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents²

Means of verification	A temporary deviation is being requested during this monitoring. The period of this deviation is between 13/11/2015 to 31/12/2015 (both days included). The reason for this deviation is that the PP could not provide calibration certificate for the biogas composition meter (parameter $f_{V_{CH_4,H,H}}$) and therefore the PPs conservatively considered all ERs achieved during this period equal to zero. For details, refer to PRC report to which this report is attached.
Findings	N/A
Conclusion	During the current monitoring period a temporary deviation is being requested. Conservatively, the PP accounted ERs equal to zero in accordance with PS para 231,b)i.

E.4.2. Corrections

Means of verification	No corrections were requested during this verification. During previous verifications, corrections were carried out and were approved on 01/07/2015 (PRC-2341-001) and on 13/12/2019 (PRC-2341-002). Nevertheless, the information is not consistent in the MR. Thus a CL has been raised.
Findings	CL 03 The information presented in the section B.2.2 of the MR stated that the corrections informed in will be requested during this verification process. Nevertheless, these corrections were already approved in the previous monitoring period.
Conclusion	During the current monitoring period no corrections were needed. The operation of the project activity is in accordance with current version of the PDD.

E.4.3. Changes to the start date of the crediting period

Means of verification	Not applied as it does not correspond to the 1 st verification process of this PA.
Findings	N/A
Conclusion	No change is due. This is not the 1 st verification of this project.

E.4.4. Inclusion of a monitoring plan

Means of verification	No inclusion of MP were requested during this monitoring period.
Findings	N/A
Conclusion	During the current monitoring period no inclusion of MP is being requested. The MP is in accordance with current version of the PDD.

² Other standards, methodologies, methodological tools and guidelines (to be) applied in accordance with the applied(selected) methodologies are collectively referred to as the other (applied) methodological regulatory documents).

E.4.5. Permanent changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other methodological regulatory documents

Means of verification	No permanent changes from registered MP were requested during this monitoring period. Changes in the MP have been requested previously and was approved on 01/07/2015 (PRC-2341-001)
Findings	N/A
Conclusion	During the current monitoring period no permanent changes of MP were needed. The operation of the project activity is in accordance with current version of the PDD.

E.4.6. Changes to the project design

Means of verification	No changes to the project design were requested during this monitoring period.
Findings	N/A
Conclusion	During the current monitoring period no permanent changes of MP were raised. The operation of the project activity is in accordance with current version of the PDD.

E.4.7. Changes specific to afforestation and reforestation project activities

Means of verification	Not applicable as it does not refer to afforestation or reforestation PA.
Findings	N/A
Conclusion	N/A

E.5. Compliance of the registered monitoring plan with applied methodologies, applied standardized baselines, and other applied methodological regulatory documents

Means of verification	The MP of the registered PDD was reviewed against the monitoring requirements of the applied methodologies and applicable tools.
Findings	-
Conclusion	The MP of the project activity is totally in accordance with the applied methodology - AMS-III.H. ver. 09.0 – “Methane recovery in wastewater treatment” and applied versions of TOOL03, TOOL04 and TOOL05.

E.6. Compliance of monitoring activities with the registered monitoring plan

E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

Means of verification	<p>According to the registered PDD, the following parameters are fixed for the crediting period:</p> <ol style="list-style-type: none"> Q_y: The flow of influent wastewater to the WWTP-C in year “y” of a crediting period. This parameter correspond to the wastewater flow estimated for determining the ex-ante ERs. This parameter is not applied in the ER calculations during the verification processes, therefore, not applied in this period. TSS: Average concentration of total suspended solids (TSS) present in the influent wastewater entering the WWTP-C. The value corresponds to the concentration of total suspended solids presented in the influent wastewater measured prior the implementation of PA. It was applied in the ex-ante ER calculations and will not be applied during the verification process. μ_{removal TSS}: Average efficiency of the removal of TSS in the WWTP-C. This parameter was measured prior the implementation of the PA and was applied in the ex-ante ER calculations. It will not be applied during the verification process %DM: Percentage of dry matter from untreated sludge generated from the WWTP-C sedimentation tanks. This parameter was measured prior the
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	<p>implementation of the PA and was applied in the ex-ante ER calculations. It will not be applied during the verification process</p> <p>5. GWP_{CH4}: Methane Global-Warming Potential: the value of this parameter applied in the calculations is 21 tCO₂e/tCH₄ for the 1st commitment period (until 31/12/2012) and 25 tCO₂e/tCH₄ for the 2nd commitment period (from 01/01/2013 until the end of this MP) in accordance with COP/MOP decisions.</p> <p>6. D_{CH4}: Methane density: The value applied is equal to 0.7168 kg/Nm³, which is not conservative as required by PDD section B.6.1. After the findings answer, the applied value was corrected to 0.716 kg/Nm³, which is in accordance with registered PDD and applied methodology. This value refers to the most conservative value for baseline emissions as required by PDD. It is not applied in project emissions during this monitoring period.</p> <p>Nevertheless, the values applied for the Parameter D_{CH4} in the ER calculations are not conservative. Therefore a CAR has been raised.</p>
Findings	<p>CAR 01</p> <p>As per PDD description in section B.6.2, the value of Methane density to be used in the calculations will be the most conservative between 0.7164 kg/Nm³ and 0.716 kg/Nm³ for baseline emission calculations and project emissions. Nevertheless, the applied value for baseline emission is equal to 0.7168, which is not conservative.</p>
Conclusion	All fixed parameters were included in the MR section D.1 and are now in accordance with registered PDD or EB decisions conservatively.

E.6.2. Data and parameters monitored

Means of verification	<p>All monitored parameters listed in MR used to calculate baseline and project GHG emissions of the PA were checked against the registered PDD. Some inconsistencies were found when describing the parameters in section D.2 of the MR.</p> <p>The parameters of the registered PDD were verified in order to check its consistency with CDM tools and guidance to ER calculations.</p> <table border="1"> <tr> <th colspan="2">1. f_{VCH4,FG,h}: Average volumetric fraction of methane in biogas fed into the flares (μV/V)</th></tr> <tr> <th>Criteria/Requirements</th><th>Assessment Observation</th></tr> <tr> <td>Measuring / Reading / Recording frequency</td><td> <p>The parameter refers to the fraction of CH₄ in the residual gas that is flared. It is continuously read, measured and recorded every hour³ automatically by the company's supervisory system (SCADA), aggregated and reported. The measurement is carried out at wet basis as per manufacturer's specification^{18-1/}.</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis. A CL has been raised in order</p> </td></tr> </table>	1. f_{VCH4,FG,h}: Average volumetric fraction of methane in biogas fed into the flares (μV/V)		Criteria/Requirements	Assessment Observation	Measuring / Reading / Recording frequency	<p>The parameter refers to the fraction of CH₄ in the residual gas that is flared. It is continuously read, measured and recorded every hour³ automatically by the company's supervisory system (SCADA), aggregated and reported. The measurement is carried out at wet basis as per manufacturer's specification^{18-1/}.</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis. A CL has been raised in order</p>
1. f_{VCH4,FG,h}: Average volumetric fraction of methane in biogas fed into the flares (μV/V)							
Criteria/Requirements	Assessment Observation						
Measuring / Reading / Recording frequency	<p>The parameter refers to the fraction of CH₄ in the residual gas that is flared. It is continuously read, measured and recorded every hour³ automatically by the company's supervisory system (SCADA), aggregated and reported. The measurement is carried out at wet basis as per manufacturer's specification^{18-1/}.</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis. A CL has been raised in order</p>						

³ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

		to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
	Monitoring equipment	Infrared methane concentration meter (1 equipment is used at a time) Model: Beacon 110 Serial numbers of installed equipment can be observed in section E.7 below.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is $\pm 5\%$, reading $\pm 2\%$ complete scale ^{18-1/}
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy is valid for the entire range.
	Calibration frequency / interval	1 year ^{18-1/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications ^{18-1/} .
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment. See details in section E.7 below
	Is(are) the calibration(s) valid for the entire reporting period?	Yes. For calibration details refer to section E.7 below
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and reporting of emission reductions	Data management system was found to be reliable and appropriate.

	and are necessary QA/QC processes in place?	
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A
	2. $FV_{RG,h}$: Volumetric flow rate of biogas fed into flares (Nm³/h)	
	Criteria/Requirements	Assessment Observation
	Measuring / Reading / Recording frequency	<p>The parameter corresponds to the flow of the residual gas that is collected from the sludge treatment system and directed to flare. The flow is continuously monitored by one flow meters and recorded every hour⁴.</p> <p>The parameter has been monitored in wet basis as per manufacturer's specifications.^{/18-2/}</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis. A CL has been raised in order to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below.</p>
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes.
	Monitoring equipment	<p>Endres+Hauser Thermal dispersion mass flow meter (1 equipment installed at a time)</p> <p>Serial numbers of installed equipment can be observed in section E.7 below.</p>
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment 1 % reading or 0.5% of full scale as per equipment manual ^{/18-2/} .
	Is the accuracy valid for the entire measuring range or do different	Accuracy class is valid for the entire range.

⁴ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

	accuracy levels apply to different measuring ranges?	
	Calibration frequency / interval	5 years as per manufacturer's specifications ^{18-2/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment.
	Is(are) the calibration(s) valid for the entire reporting period?	For calibration details, refer to section E.7 below.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A
3. $T_{\text{flare 1}}$: Temperature in the exhaust gas of the flares to determine combustion efficiency in flare 1 (°C)		
Criteria/Requirements	Assessment Observation	
Measuring / Reading / Recording frequency	The parameter corresponds to the temperature of the flare 1 exhausting gases. The parameter is continuously read, measured and recorded every hour ⁵ automatically by SCADA.	

⁵ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

	The monitoring is in accordance with applied tool and monitoring plan, as confirmed by the diagram of the flare.
Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
Monitoring equipment	01 thermocouple at a time Manufacturer: Endres + Hauser Thermocouple Type: K Serial numbers of installed equipment can be observed in section E.7 below
Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment +/- 0.75% ^{/18-3/}
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy is valid for the entire range.
Calibration frequency / interval	1 year ^{/18-3/}
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications ^{/18-3/} .
Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment. See details in section E.7 below
Is(are) the calibration(s) valid for the entire reporting period?	For details, refer to section E.7 below.
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
Does the data management ensure correct transfer of data and reporting of emission reductions	Data management system was found to be reliable and appropriate.

	and are necessary QA/QC processes in place?	
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A
	4. $T_{\text{flare 2}}$: Temperature in the exhaust gas of the flares to determine combustion efficiency in flare 2 (°C)	
	Criteria/Requirements	Assessment Observation
	Measuring / Reading / Recording frequency	The parameter corresponds to the temperature of the flare 2 exhausting gases. The parameter is continuously read, measured and recorded every hour ⁶ automatically by SCADA. The monitoring is in accordance with applied tool and monitoring plan, as confirmed by the diagram of the flare.
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
	Monitoring equipment	01 thermocouple at a time Manufacturer: Endres + Hauser Thermocouple Type: K Serial numbers of installed equipment can be observed in section E.7 below
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment +/- 0.75% ^{/18-3/}
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy is valid for the entire range.
	Calibration frequency / interval	1 year ^{/18-3/}
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications ^{/18-3/} .	

⁶ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment. See details in section E.7 below
	Is(are) the calibration(s) valid for the entire reporting period?	For details, refer to section E.7 below.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A

5. $FV_{G1,h}$: Volumetric flow rate of biogas fed into electric generator engine 1 (Nm³/h)	
Criteria/Requirements	Assessment Observation
Measuring / Reading / Recording frequency	<p>The parameter corresponds to the flow of the residual gas that is collected from the sludge treatment system and directed to electric generator engine 1. The flow is continuously monitored by one flow meters and recorded every hour⁷.</p> <p>The parameter has been monitored in wet basis as per manufacturer's specifications.^{/18-2/}</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis.</p>

⁷ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

		A CL has been raised in order to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below.
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes.
	Monitoring equipment	Endres+Hauser Thermal dispersion mass flow meter (1 equipment installed at a time) Serial numbers of installed equipment can be observed in section E.7 below.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is $\pm 1\%$ of reading, $\pm 0.5\%$ of complete scale as per equipment manual ^{/18-2/} .
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy class is valid for the entire range.
	Calibration frequency / interval	5 years as per manufacturer's specifications ^{/18-2/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment.
	Is(are) the calibration(s) valid for the entire reporting period?	For calibration details, refer to section E.7 below.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and	Data management system was found to be reliable and appropriate.

	reporting of emission reductions and are necessary QA/QC processes in place?	
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A
	6. $FV_{G2,h}$: Volumetric flow rate of biogas fed into electric generator engine 2 (Nm³/h)	
	Criteria/Requirements	Assessment Observation
	Measuring / Reading / Recording frequency	<p>The parameter corresponds to the flow of the residual gas that is collected from the sludge treatment system and directed to electric generator engine 2. The flow is continuously monitored by one flow meters and recorded every hour⁸.</p> <p>The parameter has been monitored in wet basis as per manufacturer's specifications.^{/18-2/}</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis.</p> <p>A CL has been raised in order to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below.</p>
Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes.	
Monitoring equipment	<p>Endres+Hauser Thermal dispersion mass flow meter (1 equipment installed at a time)</p> <p>Serial numbers of installed equipment can be observed in section E.7 below.</p>	
Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is $\pm 1\%$ of reading, $\pm 0.5\%$ of complete scale as per equipment manual ^{/18-2/} .	

⁸ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy class is valid for the entire range.
	Calibration frequency / interval	5 years as per manufacturer's specifications ^{/18-2/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment.
	Is(are) the calibration(s) valid for the entire reporting period?	For calibration details, refer to section E.7 below.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A
7. $FV_{H,h}$: Volumetric flow rate of biogas fed into water heater (Nm³/h)		
Criteria/Requirements	Assessment Observation	
Measuring / Reading / Recording frequency	The parameter corresponds to the flow of the residual gas that is collected from the sludge treatment system and directed to water heater. The flow is continuously	

		<p>monitored by one flow meters and recorded every hour⁹.</p> <p>The parameter has been monitored in wet basis as per manufacturer's specifications.^{/18-2/}</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis.</p> <p>A CL has been raised in order to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below.</p>
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes.
	Monitoring equipment	<p>Endres+Hauser Thermal dispersion mass flow meter (1 equipment installed at a time)</p> <p>Serial numbers of installed equipment can be observed in section E.7 below.</p>
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is $\pm 1\%$ of reading, $\pm 0.5\%$ of complete scale as per equipment manual ^{/18-2/} .
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy class is valid for the entire range.
	Calibration frequency / interval	5 years as per manufacturer's specifications ^{/18-2/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment.

⁹ It is important to point out that although values are recorded every hour, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively.

	Is(are) the calibration(s) valid for the entire reporting period?	For calibration details, refer to section E.7 below.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A

8. $fv_{CH_4,H,h}$: Volumetric fraction of methane in biogas combusted in water heater ($\mu V/V$)	
Criteria/Requirements	Assessment Observation
Measuring / Reading / Recording frequency	<p>The parameter refers to the fraction of CH_4 in the residual gas that is combusted in the water heater. It is continuously read, measured and recorded every hour¹⁰ automatically by the company's supervisory system (SCADA), aggregated and reported. The measurement is carried out at wet basis as per manufacturer's specification.</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH_4 volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis.</p> <p>A CL has been raised in order to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below.</p>

¹⁰ It is important to point out that although values are recorded every hours, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively

	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
	Monitoring equipment	<p>Infrared methane concentration meter (1 equipment is used at a time)</p> <p>Models used during this MP:</p> <p>7. Sewerin Multitec 540 Infrared methane concentration meter</p> <p>8. RKL Infrared Beacon B110 methane concentration meter</p> <p>Serial numbers of installed equipment can be observed in section E.7 below.</p>
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is $\pm 5\%$ reading, $\pm 2\%$ at complete scale ^{18-1/} for all models used.
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy is valid for the entire range.
	Calibration frequency / interval	1 year ^{18-1/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment. See details in section E.7 below
	Is(are) the calibration(s) valid for the entire reporting period?	For calibration details refer to section E.7 below
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.	
Does the data management ensure correct transfer of data and	Data management system was found to be reliable and appropriate.	

	reporting of emission reductions and are necessary QA/QC processes in place?	
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	A temporary deviation is being requested during this monitoring period. The period of this deviation is between 13/11/2015 and 31/12/2015 (both days included). The reason for this deviation is that the PP could not provide calibration certificate for the composition meter and therefore the PPs conservatively considered all ERs achieved during this period equal to zero.
	9. $fv_{CH_4,G,h}$: Volumetric fraction of methane in biogas combusted into the electric generator engine ($\mu V/V$)	
	Criteria/Requirements	Assessment Observation
	Measuring / Reading / Recording frequency	<p>The parameter refers to the fraction of CH_4 in the residual gas that is combusted in the generator engines. One equipment is used to measure the composition of biogas that feed both engines (G1 and G2). It is continuously read, measured and recorded every hour¹¹ automatically by the company's supervisory system (SCADA), aggregated and reported. The measurement is carried out at wet basis as per manufacturer's specification.</p> <p>As per registered PDD, considering that the measurement points of biogas flow and CH_4 volumetric fraction are taken at a small distance between each other, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis.</p> <p>A CL has been raised in order to justify the compliance of this measure with applied version of TOOL06 (version 1). Refer to CL 06 below.</p>
Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes	
Monitoring equipment	<p>Infrared methane concentration meter (1 equipment is used at a time)</p> <p>Models used during this MP:</p> <p>9. Infrared methane concentration meter</p> <p>Serial numbers of installed equipment can be observed in section E.7 below.</p>	

¹¹ It is important to point out that although values are recorded every hours, there might be hours where results are missing. It occurs due to data loss from the meter. For these hours, no baseline emissions are accounted conservatively

	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	The accuracy of the equipment is $\pm 5\%$ reading, $\pm 2\%$ at complete scale ^{18-1/} for all models used.
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Accuracy is valid for the entire range.
	Calibration frequency / interval	1 year ^{18-1/}
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	The calibration interval is in line with the monitoring plan as it is set as per manufacturer's specifications.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	An accredited institution has carried out calibration of equipment. See details in section E.7 below
	Is(are) the calibration(s) valid for the entire reporting period?	For calibration details refer to section E.7 below
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Yes.
	How were the values in the monitoring report verified?	The values of the MR and ER calculations were compared against SCADA raw data in order to check its consistency.
	If applicable, has the reported data been crosschecked with other available data?	The values of the MR were reviewed by crosschecking 100% of the data submitted in daily spreadsheets downloaded directly from the SCADA system during site visit against data used in ER calculations spreadsheet.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	N/A	
10. η_{flare} : Flare efficiency		
Criteria/Requirements	Assessment Observation	

	Measuring / Reading / Recording frequency	<p>The parameter refers the flare efficiency applied to the installed enclosed flares. The default values were applied when determining the parameter, therefore no calculation is needed.</p> <p>The following values were applied:</p> <p>10. 90% of flare efficiency in the hour h if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour h and the manufacturer's specifications on proper operation of the flare are met continuously during the hour h.</p> <p>11. 50% if the temperature in the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour h, but the manufacturer's specifications^{/18-4/} on proper operation of the flare are not met at any point in the time during the hour h (manufacturer's specifications refer to minimum biogas flow and minimum methane concentration)</p> <p>12. 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500°C for more than 20 minutes during the hour h</p> <p>The values of the parameter is in accordance with applied methodology.</p>
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes
	Monitoring equipment	No equipment is used for determining the flare efficiency. Nevertheless, for the exhaust temperature of the flare, refer to parameter $T_{\text{flare},1}$ and $T_{\text{flare},2}$
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	N/A
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	N/A
	Calibration frequency / interval	N/A
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected	N/A

	frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	
	Is the calibration of measuring equipment carried out by an accredited person or institution?	N/A
	Is(are) the calibration(s) valid for the entire reporting period?	N/A
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	N/A
	How were the values in the monitoring report verified?	The applied data was directly checked at the ER calculation spreadsheets based on the conditions informed above (as per flare temperature). The formulae presented in the ER spreadsheet were checked.
	If applicable, has the reported data been crosschecked with other available data?	Not applicable as it resulted from formulae applied in the ER calculations spreadsheet based on the flare temperature.
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Correct and conservative data has been reported at ER calculation spreadsheet. Nevertheless, the determination of flare efficiency did not account the conditions explained in the registered PDD and therefore a finding has been raised. Refer to CAR 3 in section E.8.1 below.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	Not applied

11. EC _y : Grid electricity consumption in year y	
Criteria/Requirements	Assessment Observation
Measuring / Reading / Recording frequency	<p>The parameter consists in accounting for the maximum possible consumption of equipment installed under project activity based on their installed capacity and on their functioning hours as follows:</p> <p>EC = installed capacity (kW) x working hours (h)</p> <p>The following equipment were considered:</p> <p>Flare 1: 3.3 kW (2.2 kW - gas booster + 1.1 kW – ventilator)</p> <p>Flare 2: 3.3 kW (2.2 kW - gas booster + 1.1 kW – ventilator)</p> <p>Water heater: 10.0 kW (2.5 kW - gas booster + 7.5 kW – ventilator)</p>

		<p>For the operational hours, the following has been considered</p> <p>Flare 1 and 2</p> <p>13. Op flare1 and 2=0 when temperature in the exhaust gas of the flares required to determine the combustion efficiency in flare 1 and 2 is below 500°C.</p> <p>14. Op flare1 and 2=1 when temperature in the exhaust gas of the flares required to determine the combustion efficiency in flare 1 and 2 is higher than 500°C</p> <p>Water heater</p> <p>15. Op water heater=0 when the volumetric flow of biogas fed into the water heater is zero.</p> <p>16. Op water heater=1 when the volumetric flow of biogas fed into the water heater is above zero.</p> <p>Conservatively, it is assumed that all electricity consumed by these equipment are from National Grid. The measurement is carried out continuously and reported every hour, which is in accordance with PDD.</p>
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	yes
	Monitoring equipment	For the flare consumption, exhaust gas temperature is taken into account ($T_{\text{flare1 and 2}}$). For water heater, biogas flow to the equipment is considered (parameter $FV_{H,h}$). Therefore, refer to these parameters for the equipment.
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	For the flare consumption, exhaust gas temperature is taken into account ($T_{\text{flare1 and 2}}$). For water heater, biogas flow to the equipment is considered (parameter $FV_{H,h}$). Therefore, refer to these parameters for the equipment.
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	For the flare consumption, exhaust gas temperature is taken into account ($T_{\text{flare1 and 2}}$). For water heater, biogas flow to the equipment is considered (parameter $FV_{H,h}$). Therefore, refer to these parameters for the equipment.
	Calibration frequency / interval	For the flare consumption, exhaust gas temperature is taken into account ($T_{\text{flare1 and 2}}$). For water heater, biogas flow to the equipment is considered (parameter

		FV _{H,h}). Therefore, refer to these parameters for the equipment.
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	For the flare consumption, exhaust gas temperature is taken into account (T _{flare1 and 2}). For water heater, biogas flow to the equipment is considered (parameter FV _{H,h}). Therefore, refer to these parameters for the equipment.
	Is the calibration of measuring equipment carried out by an accredited person or institution?	For the flare consumption, exhaust gas temperature is taken into account (T _{flare1 and 2}). For water heater, biogas flow to the equipment is considered (parameter FV _{H,h}). Therefore, refer to these parameters for the equipment.
	Is(are) the calibration(s) valid for the entire reporting period?	For the flare consumption, exhaust gas temperature is taken into account (T _{flare1 and 2}). For water heater, biogas flow to the equipment is considered (parameter FV _{H,h}). Therefore, refer to these parameters for the equipment.
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	For the flare consumption, exhaust gas temperature is taken into account (T _{flare1 and 2}). For water heater, biogas flow to the equipment is considered (parameter FV _{H,h}). Therefore, refer to these parameters for the equipment.
	How were the values in the monitoring report verified?	Data applied in the ER calculations was checked against data from SCADA. All formulae applied for determining the equipment operation has been checked in the ER calculations spreadsheet. Nevertheless, not all electricity consumed has been taken into account in the ER calculations. Refer to CAR 3 in section E.8.1 below. After findings resolution It has been observed that all data has been provided and the parameter's value applied in the ER calculations are correct.
	If applicable, has the reported data been crosschecked with other available data?	Not applied
	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	Data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	Not applied
	12. <i>EF_{grid}</i>: Grid emission factor	

	Criteria/Requirements	Assessment Observation
	Measuring / Reading / Recording frequency	As per applied methodology, the parameter is to be calculated as per AMS-I.D. The PDD informs that the parameter is determined in accordance with AMS-I.D version 13. The weighted average method has been applied in accordance with paragraph 9 b) of this methodology. Official information from XM ¹² has been used for the EF grid calculation. It has been determined for each year the plant has consumed electricity from the grid.
	Is the measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology?	Yes.
	Monitoring equipment	Not applied
	Is the accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	Not applied
	Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Not applied
	Calibration frequency / interval	Not applied
	Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications?	Not applied
	Is the calibration of measuring equipment carried out by an accredited person or institution?	Not applied
	Is(are) the calibration(s) valid for the entire reporting period?	Not applied
	Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Not applied
	How were the values in the monitoring report verified?	Calculations have been provided to the verification team and all evidences were checked ^{/15-2/}
	If applicable, has the reported data been crosschecked with other available data?	Not applied as they are calculated based on official data. Nevertheless, the calculation has been checked.

¹² State owned company responsible for the management of National Interconnected System in Colombia.

	Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	The calculation provided were not accurate. Refer to CAR 3 and CAR 4 in section E.8.1 and E.8.2 respectively. After findings resolution, data management system was found to be reliable and appropriate.
	In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by paragraph 231 b) the CDM Project Standard for PA?	Not applied
Findings	CL 06 It is stated in the PDD that the measurement points of biogas flow and CH ₄ volumetric fraction are taken at a small distance between each other and as a consequence, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis. Nevertheless it is not clear how it complies with applicable version of TOOL06.	
Conclusion	All parameters were determined in a conservative manner and in accordance with requirements of applied tools, methodology and monitoring plan. The parameters biogas flow and methane composition are being measured in the same basis considering the biogas temperature and therefore no correction from wet to dry basis is needed as per applied TOOL06 ^{/06-6/} (version1). All parameters were duly included in the MR section D.2 as per PDD	

E.6.3. Implementation of sampling plan

Means of verification	Documents were checked and interviews with PP's representatives and personnel were performed in order check if a sampling plan was used.
Findings	-
Conclusion	Not applicable as no sampling plan was used.

E.7. Compliance with the calibration frequency requirements for measuring instruments

Means of verification	Manuals of equipment, national regulations registered monitoring plan and calibration certificates were checked in order to verify the compliance and frequency of the calibration requirements of measuring equipment. The list of equipment, as wells as their calibration dates and calibration validity are as follows:					
	Equipment /model	Parameter	Serial # / accuracy	Calibration frequency^{/18/}	Company certificate	Calibration dates
	Infrared methane concentration meter / Beacon 110	fV _{CH₄,FG,h} Residual gas into flare	Serial B110-11Z004 Operating from 27/06/2012 until 29/04/2015 Accuracy: ± 5% reading ± 2% complete scale	annual	RKI Higielectronix	01/06/2012 22/10/2012 24/07/2013 29/04/2014 14/05/2015
			Serial M2A49903 Operating from 29/04/2015	Annual	Higielectronix	13/11/2014 No

			until 10/12/2015 Accuracy: ± 5% reading ± 2% complete scale				
			Serial HX-MGF-001 Operating from 10/12/2015 until 31/12/2015 Accuracy: ± 5% reading ± 2% complete scale	Annual	Higielect ronix	04/12/2015	No
	Endres+Hau ser Thermal dispersion mass flow meter	FV _{RG,h} Biogas flow to flares	S/N: D907E202000 Operating from 08/01/2011 until 14/07/2015 Accuracy: ± 1% of reading, ± 0.5% of complete scale	5 years	Endres+ Hauser	18/10/2010	No
			S/N: F6103A02000 Operating from 14/07/2015 until 31/12/2015 Accuracy: ± 1% of reading, ± 0.5% of complete scale	5 years	Higielect ronix	27/06/2012	No
	Endres+Hau ser Thermocou ple Type K	T _{flare,1}	S/N: D9002214168 Operating from 08/01/2011 until 19/09/2013 Accuracy ± 0.75%	Annually	Endres+ Hauser Metrolog ic Colombi a SAS	30/09/2010 17/08/2011 19/09/2012	No
			S/N: F4004114168 Operating from 19/09/2013 until 31/12/2015 Accuracy ± 0.75%	Annually	Saytec Colombi a	13/07/2012 19/09/2013 31/07/2014 04/08/2015	31/07/2015 to 03/08/2015
	Endres+Hau ser Thermocou ple Type K	T _{flare,2}	S/N: D9002214168 Operating from 08/01/2011	Annually	Endres+ Hauser Metrolog ic Colombi	19/09/2012 19/09/2013 01/06/2015	19/09/2014 to 31/05/2015

			until 31/12/2015 Accuracy \pm 0.75%		a SAS Saytec Colombi a		
	Endres+Hauser Thermal dispersion mass flow meter	FV _{G1,h} Biogas flow to electricity generator 1	S/N: D907E202000 Operating from 08/01/2011 until 14/07/2015 Accuracy: \pm 1% of reading, \pm 0.5% of complete scale	5 years	Endres+Hauser	18/10/2010	No
			S/N: F6103A02000 Operating from 14/07/2015 until 31/12/2015 Accuracy: \pm 1% of reading, \pm 0.5% of complete scale		Endres+Hauser	26/06/2012	No
	Endres+Hauser Thermal dispersion mass flow meter	FV _{G2,h} Biogas flow to electricity generator 2	S/N: E3136B02000 Operating from 07/07/2011 until 21/01/2013 Accuracy: \pm 1% of reading, \pm 0.5% of complete scale	5 years	Endres+Hauser	14/04/2011	No
			S/N: D907E302000 Operating from 21/01/2013 until 03/08/2015 Accuracy: \pm 1% of reading, \pm 0.5% of complete scale	5 years	Endres+Hauser	18/10/2010	No
			S/N: E3136B02000 Operating from 03/08/2015 until 31/12/2015 Accuracy:	5 years	Endres+Hauser	14/04/2011	No

			± 1% of reading, ± 0.5% of complete scale				
	Endres+Hauser Thermal dispersion mass flow meter	FV _{H,h} Biogas flow to water heater	S/N: F2037B02000 Operating from 18/05/2012 until 31/12/2015 Accuracy: ± 1% of reading, ± 0.5% of complete scale	5 years	Endres+Hauser	07/02/2012	No
	Sewerin Multitec 540 Infrared methane concentration meter	fV _{CH₄,H,h} Residual gas to water heater	Serial 06611000335 Operating from 27/06/2012 until 28/08/2012 Accuracy: ± 5% reading ± 2% complete scale	annual	RKI Higielectronix	18/11/2011	No
	RKI Infrared Beacon B110 methane concentration meter		Serial B110-128015 Operating from 28/08/2012 until 20/11/2014 Accuracy: ± 5% reading ± 2% complete scale	Annual	RKI Higielectronix	17/08/2012	16/08/2013 to 20/11/2014
	Infrared methane concentration meter		Serial C-7743-S-7719 Operating from 20/11/2014 until 31/12/2015 Accuracy: ± 5% reading ± 2% complete scale	Annual	RKI Analytical Technology Inc Progen SA	13/11/2014	13/11/2015 to 31/12/2015 ¹³
	Infrared methane concentration meter	fV _{CH₄,G,h} Residual gas to electric generators	Serial C10-IR-501 Operating from 07/04/2011 until 31/12/2015	Annual	Analytical Technology Inc Progen SA	15/02/2011 17/09/2013 23/04/2015	01/11/2012 (start of MP) to 17/09/2013 17/09/2014 to 22/04/2015

¹³ This equipment has been replaced on 26/01/2016 and there is no calibration certificate after this date (equipment was not available). Therefore, it is not possible to check whether the error found would be higher than the maximum permissible error. For that reason, temporary deviation is being requested along this MP. Refer to section E.4.1 above.

			Accuracy: ± 5% reading ± 2% complete scale				
	As some delays in calibration were observed and the provisions from VVS para 369 were not applied a CAR has been raised.						
Findings	<p>CAR 1</p> <ol style="list-style-type: none"> 1. $f_{CH4FG,h}$: calibration delay is from 29/04/2015 to 13/05/2015 and not from 30/04/2015 to 13/05/2015 2. $f_{CH4,H,h}$ calibration delay is from 13/11/2015 to 31/12/2015 and not from 14/11/2015 to 31/12/2015 3. $f_{CH4,G,h}$: it is not clear why 2% correction factor has been applied between 01/11/2012 until 16/09/2013 if 5% is being specified by manufacturer 4. $f_{CH4,G,h}$: no calibration certificate was provided between 13/11/2014 and 22/04/2015 and no correction factor has been applied. 						
Conclusion	<p>Not all measuring equipment have been duly calibrated for the complete monitoring period.</p> <p>After findings resolution, it has been observed that the maximum permissible error of the instruments have been conservatively applied to the calibration delayed period. These correction factor has been applied to the measured values taken during the period of delayed calibration, as the results of the delayed calibrations do not show any errors or the errors were smaller than the maximum permissible errors in the measuring of all equipment, in accordance with paragraph 369 (a) of the VVS for project activities. In case calibration delays continue after the monitoring period, the next calibration certificate (after the end of MP) has been taken into account. Nevertheless, when the equipment has been replaced and no further calibration has been carried out (in case of meter C-7743-S-7719 that measures $f_{CH4,H,h}$), a temporary deviation has been requested applying most conservative values for the period. Refer to PRC report sent along this verification report. In this case, <i>Conservatively, the PP has applied zero for the ERs during the delayed period, in accordance with PS paragraph 231)b)i). In fact the measure carried out by PP is much more conservative than the requirements of this paragraph. An exercise has been carried out in the original excel spreadsheet^{10/} (version 5.1) and if only baseline emissions related to the water heater (measured by meter SN C-7743-S-7719) has been considered equal to zero, the total CERs will reduce from 153,128 to 148,412 tCO₂e. But as the PPs considered equal to zero all ERs generated during this period, the final CERs are equal to 147,068 tCO₂e, which is way conservative.</i></p> <p>The application of correction factor are duly traceable in the ER calculation spreadsheet^{10/} which are considered correct and conservative by the verification team (reduction of ERs were seek when applying correction factors). The correction factors were applied to all days which calibration was delayed.</p> <p>Calculations are considered accurate and conservative.</p>						

E.8. Assessment of data and calculation of emission reductions or net removals

E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

Means of verification	<p>The calculations of baseline emission have been done in accordance with registered monitoring plan and applied methodology. The only source of baseline emissions is the methane capture by the sludge treatment system and combusted either in flares, engines or water heater.</p> <p>The equation used is as follows:</p> $BE_h = MEP_{h,s,treatment} \times GWP_{CH4}$
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	<p>Where:</p> <ul style="list-style-type: none"> - BE_h; baseline emissions in hour h; - $MEP_{h,s,treatment}$; Methane emission potential of the sludge treatment system in hour "h"; - GWP_{CH4}; Global warming potential of methane. <p>In the monitoring period (ex-post), the calculation of the parameter $MEP_{h,s,treatment}$ is carried out as follows:</p> $MEP_{h,s,treatment} = (FV_{RG,h} \times f_{v_{CH4,FG,h}} \times \eta_{flare} + FV_{H,h} \times f_{v_{CH4,H,h}} + (FV_{G1,h} + FV_{G2,h}) \times f_{v_{CH4,G,h}}) \times D_{CH4}$ <p>Where</p> <p>$FV_{RG,h}$ = Volumetric flow rate of biogas fed into flares (Nm³/h)</p> <p>$f_{v_{CH4,FG,h}}$ = Average volumetric fraction of methane in biogas fed into the flares (μV/V)</p> <p>η_{flare} = Flare efficiency (%)</p> <p>$FV_{H,h}$ = Volumetric flow rate of biogas fed into water heater (Nm³/h)</p> <p>$f_{v_{CH4,H,h}}$ = Volumetric fraction of methane in biogas combusted in water heater (μV/V)</p> <p>$FV_{G1,h}$ = Volumetric flow rate of biogas fed into electric generator engine 1 (Nm³/h)</p> <p>$FV_{G2,h}$ = Volumetric flow rate of biogas fed into electric generator engine 2 (Nm³/h)</p> <p>$f_{v_{CH4,G,h}}$ = Volumetric fraction of methane in biogas combusted into the electric generator engine (μV/V)</p> <p>D_{CH4} = Methane density kg/Nm³</p> <p>Nevertheless, some issues were found in the BE calculations and therefore a CAR has been raised.</p>
Findings	<p>CAR 03</p> <p>The followign issues have been found in the ER calculations spreadsheet</p> <ol style="list-style-type: none"> 1. tab raw data <ol style="list-style-type: none"> a. The values applied in the calculations from $FV_{H,h}$ and $f_{v_{CH4,H,h}}$ (flow and CH₄ composition to Water heater) and FV_{G1} and $G2,h$ and $f_{v_{CH4,G,h}}$ (flow and CH₄ composition to generator 1 and 2) from 18/11/2015, 0 :00hs until 11/12/2015 14 :00hs were not included in the ER calculation spreadsheet. Moreover, it has been obsreved tha the values of these parameters reported are not in accordance with the values obtained in the raw data during all monitoring period. 2. Tab ER calculations <ol style="list-style-type: none"> a. The value applied for the parameter D_{CH4} in the ER calculations columns H, N and T is not conservative as per PDD section B.6.2. 3. Tab « Raw Data_Penalization » : <ol style="list-style-type: none"> a. column L : the calculation of flare emission is not in accordance with PDD. As per formulae presented, if flare temperature is higher than 100°C, the flare efficiency is equal to 50%. Nevertheless, this condition is not correct. b. column W : considering that there are two flares, the electricity consumed when Flare 2 is operating (column C) is not being taken into account when determining the parameter EC_y. c. The values of grid emission factor applied in the calculations are not in accordance with values provided in evidences : e.g. EF for 2013 applied in the ER calculations is equal to 0.00019 tonCO₂/MWh whereas, the values calculated in the EF grid calculations spreadsheet for this year is equal to 0.19 tonCO₂/MWh
Conclusion	After findings resolution, the verification team confirms that:

	<p>a. the monitored data was available in accordance with the registered monitoring plan;</p> <p>b. the reported data were crosschecked, as prescribed in the revised approved PDD, with the relevant supporting and were found consistent;</p> <p>c. appropriate methods and formulae for calculating baseline GHG emissions have been followed;</p> <p>d. the assumptions, emission factors and default values that were applied in the calculations are correct and evidenced;</p> <p>e. the calculations are transparent, consistent, correct and complete.</p> <p>The baseline emissions results for the monitoring period are as follows:</p> <p style="text-align: center;">BE_y = 147,098 tCO₂e</p>
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E.8.2. Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

Means of verification	<p>According to the PDD and as per evidences observed during site visit, the project emissions applied to this project activity are only related to the electricity consumption by the project activity.</p> <p>As per PDD, section B.6.1, fugitive project emissions are only applicable in case the project activity implies any change in the sludge treatment, which it will not be the case. The amount of untreated sludge generated ($S_{y,untreated}$) will be the same than in the baseline scenario. Therefore, the potential to generate methane are equal in the baseline and the proposed project activity. This measure has been clarified in the correction #10 of the current valid version of the PDD (Appendix 7 correction #10 of PDD^{/05/}).</p> <p>Although, fugitive emissions are not being taken into account directly in the PE calculations as stated in the registered PDD, the emissions due to the flare inefficiencies are already being discounted as the baseline emissions as the amount of methane combusted in the flare are being multiplied by the parameter η_{flare}. Refer to formula for calculation of $MEP_{h,s,treatment}$ in the section E.8.1 above. Therefore, these emissions are being discounted from baseline emissions.</p> <p>Therefore, only PE_{power} is being considered,</p> $PE_y = PE_{h,power} = EC_h \times EF_h$ <p>Where</p> <p>$PE_{h,power}$ = Project emissions due to electricity consumption in the project activity EC_h = Grid electricity consumption for the operation of the flares in the hour "h" EF_h = Emission factor for grid electricity in the hour h</p> <p><u>Electricity consumed by project activity (EC_h)</u></p> <p>For this Project activity, in accordance with registered PDD and as it could be observed during site visit, the electricity consumed will not be measured but calculated by the installed capacity of the equipment <i>times</i> the amount of time these equipment are operating as following:</p> <p>EC = installed capacity (kW) x working hours (h)</p> <p>The following equipment were considered (their installation could be evidenced during OSV^{/14/}):</p> <p>Flare 1: 3.3 kW (2.2 kW - gas booster + 1.1 kW – ventilator)</p> <p>Flare 2: 3.3 kW (2.2 kW - gas booster + 1.1 kW – ventilator)</p> <p>Water heater: 10.0 kW (2.5 kW - gas booster + 7.5 kW – ventilator)</p>
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	<p>For the operational hours, the following has been considered</p> <p>Flare 1 and 2</p> <p>17. Op flare1 and 2=0 when temperature in the exhaust gas of the flares required to determine the combustion efficiency in flare 1 and 2 is below 500°C.</p> <p>18. Op flare1 and 2=1 when temperature in the exhaust gas of the flares required to determine the combustion efficiency in flare 1 and 2 is higher than 500°C</p> <p>Water heater</p> <p>19. Op water heater=0 when the volumetric flow of biogas fed into the water heater is zero.</p> <p>20. Op water heater=1 when the volumetric flow of biogas fed into the water heater is above zero.</p> <p>These conditions above could be duly observed in the ER calculations spreadsheet and are considered accurate.</p> <p><u>Grid emission factor calculation (EF)</u></p> <p>As per applied methodology, the parameter is to be calculated as per AMS-I.D version 13. The PP has applied the weighted average method in accordance with paragraph 9 b) of this methodology for each year the project is consuming electricity from the grid as follows:</p> $EF = \frac{\sum(EG_{m,y} \times EF_{CO_2,i})}{EG_y}$ <p>Where</p> <p>$EG_{m,i,y}$ = electricity generated by power plant m connected to the grid in year y</p> <p>$EF_{CO_2,i}$ = CO₂ emission factor of fuel i consumed by plant m</p> <p>EG_y = total electricity generated by grid in year y</p> <p>As issues were found when calculating the grid emission factor, a finding has been raised.</p>
Findings	<p>CAR 04</p> <p>The followign issues have been found in the values applied for grid emission factor</p> <ol style="list-style-type: none"> 1. The formula of applied calculation has not been included in section E.2 of MR. 2. the calculations from 2012 and 2015 were not provided to the verification team. 3. The generation data (raw data) provided from 2014 is not in accordance with data obtained in XM website (tab « 2014 Raw data » column A states that the data is from 2011) 4. When calculating the weighted average, fuels such as GAS NI, BIOMASS, BIOGAS, RAD SOLAR, among others are not being taken into account (total generation differs from generation accounted in teh calculations).
Conclusion	<p>After findings resolution, the verification team confirms that:</p> <ol style="list-style-type: none"> a. the monitored data was available in accordance with the registered monitoring plan; b. the reported data were crosschecked, as prescribed in the revised approved PDD, with the relevant supporting and were found consistent; c. appropriate methods and formulae for calculating baseline GHG emissions have been followed; d. the assumptions, emission factors and default values that were applied in the calculations are correct and evidenced; e. the calculations are transparent, consistent, correct and complete. <p style="text-align: right;">PE_{EC} = PE_y = 31 tCO₂e</p>

E.8.3. Calculation of leakage GHG emissions

Means of verification	No leakage emissions are to be considered in this project activity as per PDD and per the applied methodology. $LE_y = 0 \text{ tCO}_2\text{e}$
Findings	-
Conclusion	The verification team confirms that: <ol style="list-style-type: none"> the monitored data was available in accordance with the registered monitoring plan; the reported data were crosschecked, as prescribed in the revised approved PDD, with the relevant supporting and were found consistent; appropriate methods and formulae for calculating baseline GHG emissions have been followed; the assumptions, emission factors and default values that were applied in the calculations are correct and evidenced.

E.8.4. Summary calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

Means of verification	The emission reductions from the project activity are based on baseline and project emissions only. The calculations presented at the final MR and corresponding ER calculation spreadsheet were found to be appropriate and in compliance with the provisions of the registered monitoring plan of the approved PDD and applied methodology. The verification team confirms an audit trail that contains the evidences and records of validated figures. Nevertheless, the application of flare efficiency in the BE formula in section E.1 of the MR is not clear. Moreover, the application of fugitive emissions is not clear in the MR and therefore CLs have been raised
Findings	CL 04 MR section E.1: it is not clear the application of the flare efficiency in the BE formula CL 05 The application of fugitive emissions is not clear in the MR and therefore a CL has been raised.
Conclusion	The verification team confirms that appropriate methods and formulae for calculating baseline GHG emissions reductions have been followed. The summary table has been correctly presented at the MR and the figures are correct and justified.

E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Means of verification	The actual emission reductions were checked against the estimates of the registered PDD. All calculations were duly provided in the ER calculations spreadsheet. Moreover, the MR has been filled accordingly. The comparison is considered accurate by verification team.
Findings	
Conclusion	The comparison of actual values of the monitoring period with the estimates in the registered PDD is now properly presented at the MR taken into account comparative periods.

E.8.6. Remarks on difference from estimated value in registered PDD

Means of verification	It has been observed that actual ERs are lower than the estimated ERs. The calculation is considered accurate and therefore no justification is needed.
Findings	N/A
Conclusion	As the actual achieved ERs are lower than the estimated in the registered PDD, no remarks are necessary.

E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Means of verification	ESPL is able to certify that the emission reductions from the CDM project activity “Introduction of the recovery and combustion of methane in the existing sludge treatment system of the Cañaveralejo Wastewater Treatment Plant of EMCALI in Cali, Colombia” – Ref. 2341 for the monitoring period from 01/11/2012 to 31/12/2015 (including both days).	
	Verified and certified emission reductions as per commitment period:	
	Commitment period	Amount
	Up to 31/12/2012	4,779 tCO2e
	From 01/01/2013 until 31/12/2020	142,288 tCO2
	From 01/01/2021	0 tCO2e
Findings	N/A	
Conclusion	The total amount of GHG emissions reductions have been generated partially until 31/12/2012 and partially between 01/01/2013 and 31/12/2020.	

E.9. Assessment of reported sustainable development co-benefits

Means of verification	The project participants have not monitored sustainable development co-benefits of the registered CDM project activity.
Findings	-
Conclusion	Not applicable.

E.10. Global stakeholder consultation

Means of verification	The MR has been made public available at UNFCCC website on 27/11/2020. No comments have been received.
Findings	-
Conclusion	No comments were received after the publication of the MR for global stakeholder consultation.

SECTION F. Internal quality control

The draft verification report that is prepared by verification team is reviewed by an independent technical review team (one or more members) to confirm if the internal procedures established and implemented by ESPL were duly complied with and such opinion/conclusion is reached in an objective manner that complies with the applicable CDM rules/requirements.

The technical review team is collectively required to possess the technical expertise of all the technical area/sectoral scope to which the project activity is related. All members of technical review team are independent of the verification team.

During the technical review process, additional findings may be identified or the closed out findings may be opened, which needs to be satisfactorily resolved before the request for issuance is submitted to UNFCCC. The independent technical reviewer may either approve the report as such or reject/return the same in such case providing the comments/findings/issues that needs to be resolved by the verification team. The decision taken by the technical reviewer is final and is authorized on behalf of ESPL.

SECTION G. Verification opinion

ESPL, contracted by ALLCOT AG, has performed the independent verification of the emission reductions for the CDM project activity “Introduction of the recovery and combustion of methane in the existing sludge treatment system of the Cañaveralejo Wastewater Treatment Plant of EMCALI in Cali, Colombia” – Ref.: 2341 – in Colombia, for the monitoring period from 01/11/2012 to 31/12/2015 (including both days) as reported in the draft Monitoring Report.

ALLCOT AG is responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the project activity.

ESPL commenced the verification based on the baseline and monitoring methodology AMS-III.H ver 09.0, the monitoring plan contained in the valid version of PDD^{/10/} and draft Monitoring Report.

ESPL's verification approach is based on the understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. ESPL planned and performed the verification by obtaining evidence and other information and explanations that ESPL considered necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

The verification team confirms that:

- the project activity was found completely implemented as per the description given in the registered PDD; and
- the actual operation conforms to the description in the registered PDD.

SECTION H. Certification statement

ESPL, contracted by ALLCOT AG, has performed the independent verification of the emission reductions for the CDM project activity "Introduction of the recovery and combustion of methane in the existing sludge treatment system of the Cañaveralejo Wastewater Treatment Plant of EMCALI in Cali, Colombia" – Ref.: 2341 – in Colombia for the monitoring period from 01/11/2012 to 31/12/2015 (including both days), as reported in the final version of the Monitoring Report.

It is our responsibility to express an independent verification statement on the reported GHG emission reductions from the project activity.

In our opinion, the GHG emissions reductions reported for the project activity for the monitoring period are fairly stated in the final version of the Monitoring Report. The GHG emission reductions were correctly calculated based on the approved baseline and monitoring methodology and the monitoring plan contained in the PDD.

ESPL is able to certify that the emission reductions of CDM project activity mentioned above, during the present monitoring period, totalize the amount of:

Up to 31/12/2012	4,779 tCO ₂ e
From 01/01/2013 until 31/12/2020	142,288 tCO ₂
From 01/01/2021	0 tCO ₂ e
TOTAL for MP	147,067 tCO₂e.

Appendix 1. Abbreviations

Abbreviations	Full texts
BE	Baseline Emission
BM	Build Margin
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CL	Clarification Request
CM	Combined Margin
CME	Coordinating/Managing Entity
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
CP	Crediting Period
DOE	Designated Operational Entity
EB	Executive Board
EIA	Environmental Impact Assessment
ESPL	Earthood Services Private Limited
FAR	Forward Action Request
GHG	Green House Gas
GSC/GSP	Global Stakeholder Consultation Process
GW	Giga Watt
GWh	Giga Watt hour
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
kW	kilo Watt
kWh	kilo Watt hour
LoA	Letter of Approval/Authorization
MoC	Modalities of Communication
MoV	Means of Validation
MP	Monitoring Plan
MW	Mega Watt
MWh	Mega Watt hour
OM	Operating Margin
PA	Project Activity
PCP	Project Cycle Procedure
PDD	Project Design Document
PE	Project Emission
PP	Project Participant
PS	Project Standard
tCO ₂ e	Tonnes of Carbon di oxide equivalent
UNFCCC	United Nations Framework Convention on Climate Change
VT	Verification Team
VVS	Validation and Verification Standard
WWTP	Wastewater treatment plant

Appendix 2. Competence of team members and technical reviewers

Competence Statement			
Name	Marcelo Sebben		
Country	Brazil		
Education	BE(Chemical Engineering) M.Sc(Sustainable Energy Systems)		
Experience	9+ years		
Field	CDM Audit, Energy, Climate Change		
Approved Roles			
Team Leader	Yes		
Validator	Yes		
Verifier	Yes		
Methodology Expert	Yes (ACM0001, ACM0002, ACM0006, AM0065, AMS.I.D, AMS.I.C, AMS.I.E, AM0026, AMS.I.A, AMS.I.F, AMS. IIIE. AMS.IIIH, AMS.III.I, AMS.III.J.)		
Local expert	Brazil, Chile, Colombia		
Financial Expert	Yes		
Technical Reviewer	No		
TA Expert	Yes (TA 1.1, 1.2, 5.1, 9.1,13.1)		
Reviewed by	Shreya Garg	Date	29/07/2020
Approved by	Anshika Gupta	Date	29/07/2020

Competence Statement			
Name	Ricardo Lopes		
Country	Brazil		
Education	Technical Diploma in Data Processing		
Experience	12 years		
Field	CDM, Energy, Environment		
Approved Roles			
Team Leader	Yes		
Validator	Yes		
Verifier	Yes		
Methodology Expert	Yes (ACM0001, ACM0002, AM0026, AMS ID, AMS III.H, AMS III.F)		
Local expert	Brazil, Argentina, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Honduras, Mexico, Nicaragua, Uruguay		
Financial Expert	Yes		
Technical Reviewer	No		
TA Expert	Yes (1.2, 13.1)		
Reviewed by	Shreya Garg	Date	04/06/2019
Approved by	Anshika Gupta	Date	04/06/2019

Competence Statement	
Name	Cristian Grisales

Education	Masters Renewable Energies		
Experience	12 years		
Field	Consultancy		
Approved Roles			
Team Leader	Yes		
Validator	Yes		
Verifier	Yes		
Methodology Expert	NO		
Local expert	Yes (Colombia)		
Financial Expert	NO		
Technical Reviewer	NO		
TA Expert (X.X)	Yes (TA 1.2, 13.1)		
Reviewed by	Deepika Mahala	Date	23/04/2021
Approved by	Ashok Kumar Gautam	Date	23/04/2021

Competence Statement			
Name	Ashok Gautam		
Country	India		
Education	M. Sc. (Environmental Sciences) M. Tech. (Energy & Environmental Management)		
Experience	16 Years +		
Field	Energy, Climate Change & Environment		
Approved Roles			
Team Leader	YES		
Validator	YES		
Verifier	YES		
Methodology Expert	AMS-I.D., AMS-I.A., AMS-I.C., AMS-I.E, AMS-II.D., AMS-II.G., AMS-III.E., AMS-III.H., AMS-III.Q, AMS-III.Z., AMS-III.AV., AMS III.AR, AM0029, AM0025, AM0056, ACM0001, ACM0002, ACM0004, ACM0012, ACM0006, AM0018, ACM0009, AM0034, AMS.I.B, ACM0003		
Local expert	YES (India)		
Financial Expert	YES		
Technical Reviewer	YES		
TA Expert	YES (TA 1.1, TA 1.2, TA 3.1, TA 13.1)		
Reviewed by	Shreya Garg	Date	15/04/2021
Approved by	Anshika Gupta	Date	15/04/2021

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
1.	UNFCCC	Standard: CDM PS for PA	version 03.0	Others
2.	UNFCCC	Standard: CDM PCP for PA	version 03.0	Others
3.	UNFCCC	Standard: CDM VVS for PA	version 03.0	Others
4.	UNFCCC	Form: CDM-MR-FORM	version 09.0	Others
5.	PP	Registered PDD (current valid version of PDD)	version 07 – 26/09/2019	Others
6.	UNFCCC	<u>Applied methodology</u> 1. AMS-III.H. Methane recovery in wastewater treatment 2. AMS.I.D.: Grid connected renewable electricity generation <u>Methodological Tools</u> 3. TOOL 03: Tool to calculate project or leakage CO2 emissions from fossil fuel combustion 4. TOOL 04: Emissions from solid waste disposal sites 5. TOOL 05: Tool to calculate baseline, project and/or leakage emissions from electricity consumption 6. TOOL06: Tool to determine project emissions from flaring gases containing methane” was followed	ver. 09.0 Ver 13.0 Version 02 Version 6.0.0 Version 01 Version 1	Others
7.	PP	Monitoring Report (draft)	version 1.0 – 09/10/2020	PP
8.	PP	Monitoring Report (revised/final)	Version 02 - 03/08/2021 Version 02.1 - 03/08/2021 Version 02.2 – 01/09/2021 Version 02.3 – 05/10/2021	PP
9.	PP	ER Spreadsheet (draft)	Version 04	PP
10.	PP	ER Spreadsheet (revised/final)	Version 05.2	PP

11.	ICONTEC	Previous verification report referring to 1MP issued by ICONTEC	Ver. 04– 29/09/2019	CDM website
12.	ICONTEC	Assessment on PRC Validation report of the PA issued by ICONTEC	Ver. 01.3 – 29/09/2019	CDM website
13.	Colombian Government	<u>National legislation</u> <ol style="list-style-type: none"> 1. Resolution 0831 from 2020 – which changes the Resolution 1447 regarding the use of Carbon Credits in the Colombian Market 2. Resolution 1447 - from Ministry of Environment and Sustainable Development, regarding the monitoring, reporting and verification of GHG mitigation actions at national Level and regulation of National GHG Emission Registration (RENARE) 3. Law 1934/2018 – Guidelines for Climate Change Management – issued by National Congress. 4. Decree 926 – National Rules for Taxes over Carbon Consumption issued by Ministry of Treasury and Public Credit of Colombia 5. Resolution 1433 – regarding the Sanitation and Vertimient Management plan issued by Ministry of Environment, Housing and Territorial Development 6. Resolution 1377 from Ministry of Environment and Sustainable Development, regarding the energy use of waste 	30/09/2020 01/08/2018 27/07/2018 01/06/2017 13/12/2004 09/06/2015	
14.	DOE	<u>Pictures from Site visit</u> <ol style="list-style-type: none"> 1. Biogas tank 2. Enclosed flares 3. Engines 4. Measurement equipment 	15/07/2021	
15.		<u>Emission reduction calculations</u> <ol style="list-style-type: none"> 1. Grid Emission factor calculations spreadsheet 2. Data from hourly generation from years 2012 to 2015 	2012 to 2015 http://portalbissrs.xm.co.m.co/oferta/Paginas/Historicos/Historicos.aspx	

		<p>(folder Generación\Generacion_kwh_YYYY)</p> <p>3. <u>Heat rate</u></p> <ul style="list-style-type: none"> Heat rate values for power plants connected to the Colombian Electric system <p>4. Heat rates for other plants based on TOOL09 - Determining the baseline efficiency of thermal or electric energy generation systems, version 03.0</p>	<p>http://paratec.xm.com.co/paratec/SitePages/generacion.aspx?q=capacidad</p> <p>https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-09-v3.0.pdf</p>	
16.	Google Maps	<p><u>Geographical Coordinates of Project activity</u></p> <p>Plot of project location in google maps in order to confirm the project location</p>	<p>https://www.google.com.br/maps/place/3%C2%B028'10.1%22N+76%C2%B028'44.0%22W/@3.469468,-76.4810875,930m/data=!3m2!1e3!4b1!4m5!3m4!1s0x0:0x0!8m2!3d3.4694626!4d-76.4788988</p>	DOE
17.	PP	<p><u>Raw data</u></p> <p>1. Daily spreadsheets with all monitored parameters referred biogas measurement extracted directly from SCADA system (hourly data), downloaded during site visit</p>	15/07/2021	Other
18.	Endress+Hauser RKI	<p>Technical information of equipment used in the PA</p> <p>1. <u>Gas analyser:</u></p> <ul style="list-style-type: none"> Accuracy: RKI: Operator's manual 71-0305RK from 12/03/2018 stating accuracy equal to 5% reading or 2% complete scale. Calibration frequency: RKI: Operator's manual 71-0305RK from 12/03/2018 stating recommended calibration every year <p>2. <u>Gas flow meter</u></p> <ul style="list-style-type: none"> Letter from E+H regarding the calibration frequency of 	19/01/2011	Other

		<p>E+H flow meter equal to 5 years</p> <p>b. Accuracy: Endress+Houser Technical report Proline t-mass 65F, 65I stating maximum error equal to 1 % reading or 0.5% of full scale.</p> <p>3. <u>Thermocouple (exhaust gas)</u></p> <p>a. Accuracy: According to standard ASTM E230/E230M and ASTM E680/E680M</p> <p>b. Calibration frequency: Letter from E+H regarding the calibration frequency of E+H flow meter equal to 1 year</p> <p>4. <u>Enclosed flare</u></p> <p>a. Manual Flare 300m³ - Biogas 300m³h⁻¹ CEN, issued by Biogas Technology Ltd., Doc. No: 2949TM Issue: 0.1, stating minimum methane concentration of 20%</p> <p>b. Guidance-on-landfill-gas-flaring, section 4.8.7, where it is stated that a turn-down ratio (ratio of minimum gas flow to maximum gas flow under satisfactory operating conditions) is equal to 5:1, and therefore, considering that in the PDD, pg 7, it is defined flare flow of m³/h, the minimum flow estimated is determined as 110 m³/h</p>	<p>https://www.thermocoupleinfo.com/type-s-thermocouple.htm</p> <p>19/01/2011</p> <p>www.environment-agency.gov.uk</p>	
19.	<p>RKI instruments</p> <p>HX Higielectronix</p>	<p><u>Calibration Certificates (for the calibration dates and validity, refer to Section E.7 above):</u></p> <p>1. <u>Gas analyser</u></p> <p>a. RKI instruments calibration certificates</p>		PP

	Revicol Ltda Progen Endress+Houser	b. Higielectronix Calibration certificates c. Revicol Ltda Calibration certificates d. Progen Calibration certificates 2. <u>Flow meter:</u> a. Endress+Houser Calibration certificates 3. <u>Thermocouple (residual gas)</u> a. Endress+Houser Calibration certificates b. Metrologic Colombia S.A calibration certificates c. SAYTEC COLOMBIA Calibration certificates		
20.	Santiago de Cali City hall	<u>Operational License:</u> 1. Resolution 4133.0.21.1484 issued by Santiago de Cali City hall	30/12/2016	PP
21.	PP	ERPA - CON-PUR-EMC – ERPA ref# AG18-OP-034 regarding the CERs purchase - RES 1447 DE 2018 – Art. 17, para 3 - regarding the Colombian Carbon Market (it is stated that the CERs have expiring date of 5 years for being eligible in the Colombian Market)	25/09/2018 01/08/2018	Other
22.	-	DNA of Colombia (Ministry of Environment and Sustainable Development)	http://www.minambiente.gov.co/	Other
23.	Minambiente	National Registration of Emission Reductions (RENARE)	http://renare.siac.gov.co/GPY-web/#/ingresar	Other
24.	PP	Service order #300-GAA-OS-300-2010 signed between EMCALI and Consortium PTAR MDL regarding the instruments installation of the CDM project activity (, page 6))	26/082010	PP
25.	PP	<u>Evidences of biogas temperature below 60°C</u> 1. Operation manual of Wastewater plant	Rev.b	PP

	Metcalf and Eddy/AECOM	<p>Cañaveralaje, # O-505-97-ALC, where it is stated that the digestion process is mesophilic and that the temperature needs to be kept within 35°C.</p> <p>2. Wastewater Engineering Treatment and Resource Recovery (on pages 3-5 of this evidence, it has been informed that the mesophilic anaerobic digestion (used in this PA) is the most common digesting process and its temperature ranges between 30°C and 38°C)</p> <p>3. Evidences of installed temperature controllers to keep the sludge temperature on 35°C (Pictures)</p>	2014	
26.	IPCC	IPCC publications	www.ipcc-nggip.iges.or.jp	Other
27.	UNFCCC	UNFCCC	http://cdm.unfccc.int	Other

Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. Remaining FAR from validation and/or previous verifications

FAR ID	xx	Section no.	x	Date: DD/MM/YYYY
Description of FAR				
<i>Not applied</i>				
Project participant response				Date: DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				
				Date: DD/MM/YYYY

Table 2. CL from this verification

CL ID	01	Section no.	E.1	Date : 19/07/2021
Description of CL				
The template version of the CDM-MR-FORM applied is not the latest version available.				
Project participant response				Date : 21/07/2021
The Monitoring Report (Version 02) has been adjusted using the last CDM-MR-FORM (Version 08.0).				
Documentation provided by project participant				
Monitoring Report (Version 02)				
DOE assessment				Date: 20/08/2021
The latest version available is now being applied in the MR which is CDM-MR-FORM (version 08.0) as per UNFCCC website.				
CL is closed				

CL ID	02	Section no.	E.3	Date : 19/07/2021
Description of CL				
It is not clear whether the project activity is complying with the requirements of Colombian Resolution 1447/2018, regarding the registration of the initiative under National GHG Emission Reduction Platform (RENARE)				
Project participant response				Date : 30/07/2021
The Project have been deleted from the RENARE account of ALLCOT (consultant) and has been registered in the RENARE account of the project owner EMCALI EICE ESP. Supporting evidence is attached about the current management from EMCALI EICE ESP to register the project in RENARE under its own account.				
Documentation provided by project participant				
Evidence of RENARE Registry and communications: 1) Support evidence for RENARE registry 2) Answer from RENARE to EMCALI query				
DOE assessment				Date: 20/08/2021
The project activity is now duly registered in the platform RENARE according to the requirements of National legislation (Colombian Resolution 1447/2018) and therefore the project is now fulfilling this requirement. The project could be found in the RENARE website ^{/23/}				
CL is closed.				

CL ID	03	Section no.	E.4.2	Date : 19/07/2021
Description of CL				
The information presented in the section B.2.2 of the MR stated that the corrections informed in will be requested during this verification process. Nevertheless, these corrections were already approved in the previous monitoring period.				
Project participant response				Date : 21/07/2021

Section B.2.2. of the updated Monitoring Report (version 02) has been adjusted indicating the corrections in the category "(a) Corrections that have been approved by the Board as applicable from the period prior to this monitoring period". Additionally, it has been indicated that these corrections were part of the previous request for issuance (post-registration change PRC-2341-002 – issuance track) of the 1st monitoring report.

Documentation provided by project participant

Monitoring Report (Version 02)

DOE assessment

Date: 20/08/2021

Information has now been duly included in the MR. No corrections were required during this monitoring period and to the ones approved prior to this MP, reference number and approval dates were provided

The information is now accurate.

CL is closed

CL ID	04	Section no.	E.8.4	Date : 19/07/2021
Description of CL				
MR section E.1: it is not clear the application of the flare efficiency in the BE formula.				
Project participant response				Date : 22/07/2021
Section E.1. of the updated Monitoring Report (version 2) has been adjusted including the parameter η_{flare} in the BE formula and explaining its calculation.				
Documentation provided by project participant				
Monitoring Report (Version 02)				
DOE assessment				Date: 20/08/2021
<p>The information is now duly clarified in the MR. Although the formula PE_{flare} is being presented in the PDD, these project emission are being directly discounted from Baseline emissions as can be seen in the ER calculations, by multiplying the methane diverted to flare by the flare efficiency (η_{flare}).</p> <p>It is important to point out that according to the applied methodology and PDD (information clarified in Appendix 7, correction # 10 of current valid version of PDD), the project emissions from flare shall be discounted from baseline emissions.</p> <p>The verification team considers that the calculations are accurate and that all project emissions form flare are being duly discounted from baseline emissions as required by applied methodology.</p> <p>The measure is also being duly explained in the verification report section E.8.1 and E.8.2</p>				
<u>CL is closed</u>				

CL ID	05	Section no.	E.8.4	Date : 19/07/2021
Description of CL				
MR section E.2: it is not clear why project emission from fugitive emissions have been reported if as per PDD, section B.6.3, these emissions are equal to zero.				
Project participant response				Date : 22/07/2021
<p>In section E.2 of the Monitoring Report are explained the reasons why the fugitive emissions are equal to zero in the case of this project activity and it is indicated that the project emissions could be produced only due to the capture and combustion efficiency of the methane recovery system in the sludge treatment. Additionally, it is indicated that the project emissions will be due to the electricity consumption for the project purposes only. In section D.2 there is not any parameter reported related with fugitive emissions. Section E.1 of the updated Monitoring Report has been corrected deleting the reporting of fugitive emissions in the calculation example for 23/02/2013 at 19:00 PM.</p>				
Documentation provided by project participant				
Monitoring Report (Version 02)				
DOE assessment				Date: 20/08/2021
<p>According to current valid version of the PDD (information clarified in Appendix 7, correction # 10 of current valid version of PDD), project emissions from fugitive emissions are considered equal to zero. As already explained in finding CL04 and sections E.8.1 and E.8.2 of the verification report, although these emissions are not considered, project emission from flare are duly accounted by multiplying the flare efficiency (parameter η_{flare}) to the amount of methane combusted in flare in the baseline emission calculations (BE_n). The information now is coherent in the MR when compared to the PDD.</p>				
<u>CL is closed</u>				

CL ID	06	Section no.	E.6.2	Date : 03/10/2021
Description of CL				
<p>It is stated in the PDD that the measurement points of biogas flow and CH₄ volumetric fraction are taken at a small distance between each other and as a consequence, the characteristics of parameters regarding humidity rate, temperature and pressure are similar, and therefore, it is not necessary to bring the measurements to dry basis. Nevertheless it is not clear how it complies with applicable version of TOOL06.</p>				
Project participant response				Date : 05/10/2021
<p>Registered PDD refers in page 30 to the "Tool to determine project emissions from flaring gases containing methane, version 1 (UNFCCC Annex 13) so the information stated in version 2 of the tool is not applicable to the Monitoring Report. The version 1 of the tool states that "It is necessary to refer both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) to the same reference condition that may be dry or wet basis. If the residual gas moisture is significant (temperature greater than 60°C), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before sample analysis)"</p> <p>According to this version of the tool, if the equipment that measures the composition of biogas measures it in the same condition (wet or dry) as the equipment that measures the flow and both measurements are in the same conditions, there is no need to change the calculations from wet basis to dry basis.</p> <p>It is important to note that the biogas that burns in the flares is with the amount of moisture with which it originated in the digesters and the methane concentration and biogas flow are measured both in wet basis. This applies for all the biogas lines to the flares, engines and water heater. The temperature of the biogas is measured by the flowmeters as this equipment automatically issue the measurement in normalized conditions, however, the temperature of the biogas is not delivered by the SCADA as raw data so there is not record of this parameter as it is not included in the Monitoring Plan.</p> <p>Additionally, although it is established that the measurements are carried out in wet conditions according to the PDD, according to the "Tool to determine project emissions from flaring gases containing methane, version 1 (UNFCCC Annex 13), if it can be confirmed that temperature of the biogas is below 60°C, no significant moisture occur and therefore it can be assumed that both measurements are in dry basis. The following information attached show that the temperature of the biodigesters, and therefore from biogas, never overcome 40°C.</p> <p>In the Operation and Maintenance Manual the operating temperature of the WWTP-C biodigesters is indicated, which are mesophilic (see attachment # 4, page 4). Anaerobic digestion is carried out in the mesophilic range, controlling the temperature to 35 °C by external heating of a recirculated part of sludge. The external heating of the sludge is carried out using the plant's own energy by combustion of the biogas. The sludge is reheated in exchangers, maintaining the proper temperature for the digester sludge.</p> <p>The literature (example attached from Metcalf & Eddy, 2014, "Wastewater Engineering. Treatment and Resource Recovery") explains the temperature ranges at which mesophilic bacteria work in an anaerobic digester, and what are the effects if this temperature is changed (see attachment # 5, pages 3-5). This article states that "Temperature not only influences the metabolic activities of the microbial population but also has a profound effect on such factors as gas transfer rates and the settling characteristics of biological sludges. In anaerobic digestion, temperature is important in determining the rate of digestion, particularly the rates of hydrolysis and methane formation. The minimum Solid Retention Time (SRT) required to achieve a given amount of Volatile Suspended Solids (VSS) destruction is based on the design operating temperature. Most anaerobic digestion systems are designed to operate in the mesophilic temperature range, between 30 and 38 °C".</p> <p>Evidence of the existing temperature control and monitoring system in WWTP-C (see attachment # 6). This attachment shows that temperature of the system is maintained at 36.8 °C.</p>				
Documentation provided by project participant				
Monitoring Report (Version 02.3)				
DOE assessment				Date: 05/10/2021

It is important to state that this parameter has been taken from TOOL06 version 1^{/06-6/}. According to this tool's version, if the measurements of volumetric fraction of methane are carried out in the same basis as the volumetric flow, no correction from wet to dry basis is to be carried out. Moreover, the project participants provided evidences^{/25/} that prove that the sludge, and consequently the gas temperature is kept below 60°C and therefore, no significant moisture is contained in the biogas. Consequently, measurements carried out in dry or in wet basis will not differ significantly and therefore not correction from wet to dry was needed. Refer to the page 9 of the applied version of the TOOL06 (version 1)¹⁴.

Moreover, as per operation manual^{/25-1/} if temperature raises close to 60°C the anaerobic condition does not occur and no methane is generated.

The verification team agrees that the monitoring of parameters biogas flow and methane composition is carried out in accordance with applied version of TOOL06, which is version 1, as per PDD pg 39 and therefore, no correction from wet to dry basis is needed. Furthermore, the verification team agrees that the project participants have provided enough evidences^{/25/} to sustain their justification.

CL is closed

Table 3. CAR from this verification

CAR ID	01	Section no.	E.6.1	Date	: 19/07/2021
Description of CAR					
As per PDD description in section B.6.2, the value of Methane density to be used in the calculations will be the most conservative between 0.7164 kg/Nm3 and 0.716 kg/Nm3 for baseline emission calculations and project emissions. Nevertheless, the applied value for baseline emission is equal to 0.7168, which is not conservative.					
Project participant response					Date : 28/07/2021
Section D.1 of the updated Monitoring Report (version 02) has been adjusted using as value for methane density = 0.716 in order to be conservative and aligned with the monitoring plan as per registered PDD. The ER calculation spreadsheet has been tested using both values for methane density 0.7164 kg/Nm3 and 0.716 kg/Nm3 and the value of 0.716 kg/Nm3 has been finally selected and used as it results in a smaller value of emission reductions (more conservative option).					
Documentation provided by project participant					
Monitoring Report (Version 02) ER calculation spreadsheet (Version 05)					
DOE assessment					Date : 23/08/2021
Conservative value has now been applied in the ER calculations for the parameter methane density.					
The calculations are now accurate and conservative.					
CAR is closed					

CAR ID	02	Section no.	E.7	Date	: 19/07/2021
Description of CAR					
The following issues have been found in the application of correction factors due to calibration delays					
<ol style="list-style-type: none"> 1. $f_{CH_4FG,h}$: calibration delay is from 29/04/2015 to 13/05/2015 and not from 30/04/2015 to 13/05/2015 2. $f_{CH_4,H,h}$ calibration delay is from 13/11/2015 to 31/12/2015 and not from 14/11/2015 to 31/12/2015 3. $f_{CH_4,G,h}$: it is not clear why 2% correction factor has been applied between 01/11/2012 until 16/09/2013 if 5% is being specified by manufacturer 4. $f_{CH_4, G,h}$: no calibration certificate was provided between 13/11/2014 and 22/04/2015 and no correction factor has been applied. 					
Project participant response					Date : 03/08/2021

¹⁴ It worth mentioning that unlike stated in the issue #2 raised during incomplete, the applied version of TOOL06 is version 1 and not Version2.

1. The gap period (from 29/04/2015 to 13/05/2015) used for the application of the correction factor for parameter $f_{vCH4FG,h}$ calibration has been adjusted in the updated Monitoring Report (version 02) and updated ER calculation spreadsheet.
2. The gap period (from 13/11/2015 to 31/12/2015) used for the application of the correction factor for parameter $f_{vCH4,H,h}$ calibration has been adjusted in the updated Monitoring Report (version 02) and updated ER calculation spreadsheet.
3. The correction factor for parameter $f_{vCH4,G,h}$ calibration gap between 01/11/2012 - 17/09/2013 has been adjusted to 5% in the updated Monitoring Report (version 02) and updated ER calculation spreadsheet. The calibration gap has been changed from 01/11/2012 until 16/09/2013 to 01/11/2012 until 17/09/2013 to be conservative and aligned with "Control_Calibraciones_MDL_PTAR_C".
4. Maximum permissible error (5%) has been applied to this period for the parameter $f_{vCH4,G,h}$, as no calibration certificate was available for the period between 13/11/2014 and 22/04/2015.

Documentation provided by project participant

Monitoring Report (Version 02)
ER calculation spreadsheet (Version 05)
Certificate-HX-CC-MG-2471

DOE assessment**Date:** 01/10/2021

The application of correction factor due to calibration delays in the meters mentioned above have now been duly considered in the ER calculations. The maximum factor between the error obtained and the maximum permissible error for each equipment has been applied conservatively, as required by VVS paragraph 366. Nevertheless, the following has been observed.

- parameter T_{flare1} :
 - o The equipment 1 (Serial D9002214168) was calibrated on 19/09/2012 and valid until 18/09/2013. On 19/09/2013 it has been replaced by equipment 2 (Serial F4004114168) calibrated on 19/09/2013. Therefore, it is not clear why delay has been taken into account from 12/07/2013 to 19/09/2013 (see QA/QC procedures section and ER calculations tab Raw data Penalization) considering that the equipment F4004114168 was not installed during this delayed period.
- Parameter $f_{vCH4,H,h}$
 - o The equipment 2 (Serial Number: B110-128015) has its last calibration on 17/08/2012, valid until 16/08/2013. And the applied correction factor due to the delay has been 16/08/2013 - 13/11/2014. Nevertheless, the next equipment (Equipment 3 - Serial Number: C-7743-S-7719) was installed only on 20/11/2014. Therefore no calibration certificate covers the period between 13/11/2014 and 19/11/2014.
 - o considering that no calibration certificate has been provided to the meter C-7743-S-7719 which measures the parameter for the period between 13/11/2015 to 31/12/2015, it is not clear how the application of correction factor complies with VVS-PA paragraph 366 which requires that the maximum permissible error is applied if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error

CAR remains open**Project participant response****Date :** 04/10/2021

- parameter T_{flare1} : QA/QC procedures section of the MR (v2.3) and ER calculations tab Raw data Penalization (v5.2) has been adjusted deleting this delayed period as there was not delay in the calibration frequency in this case.
- Parameter $f_{vCH4,H,h}$:
 - o QA/QC procedures section of the MR (v2.3) and ER calculations tab Raw data Penalization (v5.2) has been adjusted extending this delayed period from 16/08/2013 to 19/11/2014.
 - o There is not calibration certificate available for the meter C-7743-S-7719 (equipment was not available). Therefore, it is not possible to check whether the error found would be higher than the maximum permissible error. Following the most conservative approach available, the ERs generated during this gap period has been accounted as 0 tCO₂. Monitoring Report, section D.2 and ER calculation spreadsheet have been updated

Documentation provided by project participant

- Updated Monitoring Report (v2.3)
- Updated ER calculation spreadsheet (v5.2)

DOE assessment**Date:** 05/10/2021

The information provided in the ER calculations is now in accordance with the calibration certificates provided to the verification team. The calculation is accurate.

Regarding the equipment methane concentration meter SN C-7743-S-7719, it was observed that no calibration certificate was available after the end of the MP and therefore it is not possible to check whether the error is higher than the maximum permissible error for this period. Conservatively, the PP has applied zero for the ERs during the delayed period, in accordance with PS paragraph 231(b)i). In fact the measure carried out by PP is much more conservative than the requirements of this paragraph. An exercise has been carried out in the original excel spreadsheet^{10/} (version 5.1) and if only baseline emissions related to the water heater (measured by meter SN C-7743-S-7719) has been considered equal to zero, the total CERs will reduce from 153,128 to 148,412 tCO₂e. But as the PPs considered equal to zero all ERs generated during this period, the final CERs are equal to 147,068 tCO₂e, which is way conservative. A temporary deviation has been requested for this matter

CL is closed

CAR ID	03	Section no.	E.8.1	Date : 19/07/2021
Description of CAR				
The following issues have been found in the ER calculations spreadsheet				
<ol style="list-style-type: none"> 1. tab raw data <ol style="list-style-type: none"> a. The values applied in the calculations from $FV_{H,h}$ and $fv_{CH_4,H,h}$ (flow and CH₄ composition to Water heater) and FV_{G1} and $G_{2,h}$ and $fv_{CH_4,G,h}$ (flow and CH₄ composition to generator 1 and 2) from 18/11/2015, 0 :00hs until 11/12/2015 14 :00hs were not included in the ER calculation spreadsheet. Moreover, it has been observed that the values of these parameters reported are not in accordance with the values obtained in the raw data during all monitoring period. 2. Tab ER calculations <ol style="list-style-type: none"> a. The value applied for the parameter D_{CH_4} in the ER calculations columns H, N and T is not conservative as per PDD section B.6.2. 3. Tab « Raw Data_Penalization » : <ol style="list-style-type: none"> a. column L : the calculation of flare emission is not in accordance with PDD. As per formulae presented, if flare temperature is higher than 100°C, the flare efficiency is equal to 50%. Nevertheless, this condition is not correct. b. column W : considering that there are two flares, the electricity consumed when Flare 2 is operating (column C) is not being taken into account when determining the parameter EC_y. c. The values of grid emission factor applied in the calculations are not in accordance with values provided in evidences : e.g. EF for 2013 applied in the ER calculations is equal to 0.00019 tonCO₂/MWh whereas, the values calculated in the EF grid calculations spreadsheet for this year is equal to 0.19 tonCO₂/MWh 				
Project participant response				Date : 29/07/2021
<ol style="list-style-type: none"> 1. Tab raw data: <ol style="list-style-type: none"> a. There was a failure in the SCADA system in the power generation area where the heater and generators are located and the raw data information is generated. Therefore, there was no capture of the measurement of the variables during this period. Work Order with code 300P01F001 is attached as evidence where the record of the activity that was carried out to review the loss of communication between the SCADA and the power generation area is included. In this order, the new hard disk was received on 12/10/2015, date on which the system was installed and restarted. This time lapse without availability of raw data of these parameters have been corrected as the valid raw data records downloaded during the site visit of the DOE has been cross-checked with the ERs calculations and replaced to resolve this gap. As explained bellow, an engineering service was performed in 2019 to recover and repair the database and this raw data has been replaced and used in the ER calculations. After this replacement using the valid raw data (downloaded as well by the DOE during the site visit) it can be seen that the only parameters with zero value were FV_{G1}, $G_{2,h}$ and $FV_{RG,h}$ for this period, due that during this period no biogas was conducted to the engines or the flares and the flow was conducted to the water heater only. <p>The difference between the raw data reported in the MR prepared by ALLCOT and those downloaded from the database during the verification had its origin in the change of the database manager that was carried out in the SCADA during October 11, 2019 to October 11 December 2019 according to service order No. 16210000662 and warehouse entry No. 16210000691 attached. These works were carried out within the operation and maintenance contract that the WWTP-C has with the contractor MORELCO SAS. On this date, the ORACLE v.8 database</p> 				

manager was replaced by the Microsoft SQL Server database manager as part of a SCADA upgrade process.

2. Tab ER calculations:

- a. Sheet "ER_Calculation" of updated ER calculation spreadsheet (version 05) has been adjusted in columns I, O and U with the more conservative value for D_{CH_4} , 0.000716 tCH₄/Nm³CH₄.

3. Tab « Raw Data_Penalization »:

- a. The design of the different formulas to determine the operational conditions and flare efficiency for both flares have been adjusted in the updated ER calculation spreadsheet (version 05), sheets "Raw data penalization" and "ER_Calculation". Now the option of flare efficiency = 50% is included in the calculations considering if the flares meet the manufacturer operational conditions (minimum biogas flow of 110 Nm³/h and minimum methane concentration of 20%). Thus, now the flare efficiency of the flare system (flare 1 and 2) are determined considering both the operational condition as per "Tool to determine project emissions from flaring gases containing methane" (temperature of exhaust gas higher than 500°C) and the manufacturer conditions previously mentioned as per technical recommendation for this type of flare (sources attached: technical specifications of the manufacturer and technical recommendations from "Guidance on Landfill Gas Flaring" (www.environment-agency.gov.uk)).

The manufacturer's specifications of proper operation of the flare (biogas flow higher than the minimum flow of 110 Nm³/h and methane fraction higher than the minimum value of 20%) have been determined using the technical specifications of the equipment provided by the project owner and the "Guidance on Landfill Gas Flaring" (www.environment-agency.gov.uk). As the flare system used by the project is manufactured in UK according to the technical specifications, this type of flare must follow the technical guidelines and recommendations established by the Environmental Agency of UK.

The minimum biogas flow has been conservatively determined using the maximum biogas flow as per manufacturer specifications (550 Nm³/h) and the guidelines from the UK Environmental Agency for Landfill Gas Flaring. This guideline establishes the turn-down ratio (ratio of minimum gas flow to maximum gas flow under which satisfactory operating conditions will be maintained) in 5:1 or 4:1 so in the case of the flare system used in this project is 110 Nm³/h, using the turn-down ratio of 5:1 as the most used in the sector. (As example, a flare manual for a similar enclosed flare manufactured in UK and used by Biogas Technology LTD in other CDM project, "Project 1307 : Durango – EcoMethane Landfill Gas to Energy Project", is attached as evidence of the common use of the turn-off ratio of 5:1). In the case of the methane content in the biogas, the guideline establishes a range of methane concentrations of around 20–60% by volume for a flare operating under good and safe combustion conditions so the value of 20% for methane concentration has been selected as the minimum value for optimal combustion conditions.

In the updated ER calculation spreadsheet (version 05), the operational conditions previously mentioned are checked and considering in the columns M, N, and O of the sheet "Raw data penalization" and the flare efficiency is calculated in the columns J, K and V of the sheet "ER Calculation". Finally, the final value of the efficiency, determined for the flare system (FE) is multiplied in the general formula provided in column W of the sheet "ER Calculation". Additionally, Section D.2 and E.1 of the MR (version 02) have been updated to extend information about the manufacturer specifications of proper operation of the flare.

With this update, now the flare efficiency calculation complies with the operational conditions established in the registered PDD (version 07) as per the "Tool to determine project emissions from flaring gases containing methane".

- b. Formula in column W of the sheet "Raw Data Penalization" of the updated ER calculation spreadsheet (version 05) has been adjusted to consider the appropriate electricity consumption when flare 1 and/or flare 2 are operating simultaneously or alone. It is important to note that, for calculation purposes, it was taken into account the installed capacity of 3.3 kW is the consumption per flare unit according to the manufacturer specifications.
- c. The values of grid emission factor for the different years have been adjusted in the updated ER calculation spreadsheet (version 05), sheet "Raw Data_Penalization" correcting the mistake in the units conversion. The Monitoring Report, section E.2 has been adjusted as well considering the correct values (for example, 0.195 tCO₂/MWh for the year 2013).

Documentation provided by project participant

- Monitoring Report (Version 02)
- ER calculation spreadsheet (Version 05)
- Technical specifications of the flare system
- Guidance on Landfill Gas Flaring" from UK Environment Agency.

- Example of manual for an enclosed flare manufactured in UK. (Selection of turn-off ratio of 5:1)
- RAW DATA 01 11 2012 31 12 2019 (after the engineering service of database recovery)
- Work Order maintenance SCADA 2018 16210000691
- Work Order-300P01F001
- Service order 16210000662
- UPS DE 20 KVA Delivery Certificate 2019

DOE assessment	Date: 23/08/2021
<ol style="list-style-type: none"> 1. The provided information has been checked by verification team. It was observed that now the ER calculations spreadsheet correctly reports the raw data downloaded during the site visit and also provided to the verification team as evidence. Therefore, it is confirmed that there is no data gap in the tab "raw data" from ER calculations spreadsheet and that the values of the parameters $FV_{H,h}$ and $fv_{CH_4,H,h}$ (flow and CH_4 composition to Water heater) and $FV_{G1 \text{ and } G2,h}$ and $fv_{CH_4,G,h}$ are now in accordance with evidences provided. 2. The value provided for the parameter D_{CH_4} (methane density) in ER calculations spreadsheet, tab "ER calculations", columns I, O and U (former columns H, N and T) are now conservative and in accordance with PDD section B.6.2. 3. Tab "raw data penalization" <ol style="list-style-type: none"> a. It has now been observed that in column M, conditions of flare's manufacturer specifications^{/18-4/} have been taken into account in order to determine the flare efficiency. As per this evidence, the flare is operational if it presents minimum biogas flow of 110 Nm³/h^{/18-4-b/} and minimum methane concentration of 20%^{/18-4-a/}. Moreover, specifications mentioned in PDD, which flare is considered to be operational only if flare temperature is higher than 500°C is also taken into account in columns N and O of this same tab (raw data penalization). The calculation is considered accurate by the verification team. b. It can be observed now in the ER calculations spreadsheet, tab "raw data penalization" column Z, that electricity consumed by either flare 1, flare 2 and/or water heater have been account when each of them are operational. Therefore, the calculations are now considered correct by verification team. c. The values presented now in the ER calculations spreadsheet for grid emission factor are now coherent and their measurement units are considered accurate. 	
CAR is closed	

CAR ID	04	Section no.	E.8.2	Date : 19/07/2021
Description of CAR				
<p>The following issues have been found in the values applied for grid emission factor</p> <ol style="list-style-type: none"> 1. The formula of applied calculation has not been included in section E.2 of MR. 2. the calculations from 2012 and 2015 were not provided to the verification team. 3. The generation data (raw data) provided from 2014 is not in accordance with data obtained in XM website (tab « 2014 Raw data » column A states that the data is from 2011) 4. When calculating the weighted average, fuels such as GAS NI, BIOMASS, BIOGAS, RAD SOLAR, among others are not being taken into account (total generation differs from generation accounted in the calculations). 				
Project participant response				Date : 29/07/2021
<ol style="list-style-type: none"> 1. The formula used by the applied calculation for EF has been included in section E.2. of the updated Monitoring Report (version 02). 2. The EF calculation for the years 2012 and 2015 has been revised according to the findings raised in this CAR and attached as evidence. 3. The generation data (raw data) for the year 2014, tab « 2014 Raw data » column A has been corrected and the information from 2011 has been deleted and not included in the EF calculation for 2014. 4. The EF calculation spreadsheet have been revised for the years 2012, 2013, 2014 and 2015 and all the fuel types of electricity generation are now included in the weighed average. The total electricity generation has been cross-checked between the raw data from XM and the EF calculation. Section E.2 of the updated Monitoring Report (version 02) has been adjusted as well with the new tables and values for the EF of each year. ERs calculations (version 05) have been updated considering these adjustments in the EF. 				
Documentation provided by project participant				
<p>Monitoring Report (Version 02) ER calculation spreadsheet (Version 05) (210729) Grid EF AMSID 2012-2015 Raw data MDL-23Julio2021</p>				

DOE assessment	Date: 23/08/2021
<ol style="list-style-type: none"> 1. The grid emission factor calculating formula has now been duly demonstrated in the MR section E.2. The verification team confirms that the option “weighted average emission factor” is duly allowed by applied version of the methodology (AMS-I.D) and therefore accepted for the calculations along this monitoring period. 2. The calculation of grid emission factor from 2012 until 2015 have now been provided to the verification team. Information on generation for each year has been checked on XM website^{/15-2/} and it could be observed that all information are accurate and in accordance with evidences. 3. The generation data has been corrected and it is now in accordance with generation provided by XM website^{/15-2/} for the year 2014. 4. Total generation of all power plants is now been taken into account, which is in accordance with calculation requirements. <p>Nevertheless, when checking the emission factor for each fuel presented in the tab “Heat Rates”, the conversion rate (MBTU/MWh) have only been considered for plants using coal and gas. Nevertheless, for these plants, the average for each fuel (based on HEAT RATE TERMICAS.xlsx) has not been duly calculated. Moreover, conversion rate for plants based on kerosene, combustoleo, ACPM and JET-A1 have not been considered in the EF calculations.</p> <p>CAR remains open</p>	
Project participant response	Date : 01/09/2021
The EF calculation v2 has been recalculated considering the heat rate for natural gas and coal fuels and the default efficiency factors in the case of kerosene, combustoleo and Jet-A1 as per MP3. ER calculation spreadsheet and Monitoring Report have been updated according to the new electricity grid EF.	
Documentation provided by project participant	
(210729) Grid EF AMSID 2012-2015 v2	
DOE assessment	Date: 25/09/2021
The EF calculations are now calculated in accordance with requirements of AMS.I-D.	
CAR is closed	

Table 4. FAR from this verification

FAR ID	xx	Section No.		Date: DD/MM/YYYY
Description of FAR				
Project participant response				Date: DD/MM/YYYY
Documentation provided by project participant				
DOE assessment				Date: DD/MM/YYYY

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	6 April 2021	Revision to: <ul style="list-style-type: none"> • Reflect the “Clarification: Regulatory requirements under temporary measures for post-2020 cases” (CDM-EB109-A01-CLAR).
03.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM validation and verification standard for project activities” (CDM-EB93-A05-STAN); • Make structural and editorial improvements.
02.1	11 January 2018	Editorial revision to correct the numbering of appendices in the instructions.
02.0	31 October 2017	Revision to align with the requirements of the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: project activities, verifying and certifying		