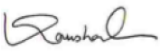
Validation report form for renewal of crediting period for CDM project activities

(Version 03.0)

BASIC INFORMATION	
Title and UNFCCC reference number of the project activity	Macaúbas Landfill Gas Project UNFCCC reference number 9063
Number and duration of the next crediting period	2nd crediting period – length: 7 years 31/07/2020 to 30/07/2027
Version number of the validation report	01a
Completion date of the validation report	17/09/2020
Version number of PDD to which this report applies	11
Project participants	Vital Engenharia Ambiental S.A.
Host Party	Brazil
Applied methodologies and standardized baselines	ACM0001: Flaring or use of landfill gas, version 19.0 Standardized baseline: N/A
Mandatory sectoral scopes	Sectoral Scope: 13 (waste handling and disposal)
Conditional sectoral scopes, if applicable	Sectoral Scope: 1 (Energy industries – renewable / non-renewable sources)
Estimated amount of annual average GHG emission reductions or GHG removals by sinks in the next crediting period	445,100 tCO_2e
Name and UNFCCC reference number of the DOE	Name: KBS Certification Services Pvt. Ltd. UNFCCC reference number: E-0051
Name, position and signature of the approver of the validation report	 Kaushal Goyal Managing Director

SECTION A. Executive summary

Purpose and general description

Macaúbas Landfill Gas Project has been developed at the "Central de Tratamento de Resíduos Macaúbas" (hereinafter referred to as CTR Macaúbas) located in the municipality of Sabará in the state of Minas Gerais, Brazil. The objective of the project activity "Macaúbas Landfill Gas Project" in Brazil is to capture landfill gas (LFG) generated through the decomposition of the organic matter of municipal solid waste disposed at the Macaúbas Landfill Gas Project site and to combust the extracted LFG, using an enclosed flare, thereby generating electricity.

The Landfill started operating in November of 2005 being able to receive approximately 3,800 tonnes of solid waste per day for an approximately 25 years of lifetime.

Verified during the remote audit the improvement of landfill gas collection and flaring, through the installation of an active recovery system composed by:

- a collection system;
- a transmission pipeline network;
- a gas station, composed by condensate separators, blowers and flaring system; and
- a power plant.

The project was registered as a CDM project on 08/11/2013 for a renewable 7-year crediting period, under the reference number 9063. The first crediting period of this project is from 31/07/2013 – 30/07/2020 and the second crediting period is from 31/07/2020 to 30/07/2027. A PRC was validated by RINA (validation report version 01.1Aa, dated 05/02/2020) and approved on 01/04/2020.

As a result, the project results in reductions of CO_2 and CH_4 emissions that are real, measurable and give long - term benefits to the mitigation of climate change.

The total emission reductions from the project are estimated to be on the average 445,100 per year over the selected 7 year for the 2nd crediting period. The emission reduction forecast has been checked, and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

Scope of validation

The purpose of a validation is to have an independent third party assess of the updated project design document to confirm that the original project baseline is still valid or has been updated taking in account of new data where applicable. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC criteria are validated in order to confirm the correctness of the application of the approved baseline methodologies for the determination of the continued validity of the baseline or its update, and estimation of the emission reductions for the applicable crediting period.

The validation scope is defined as an independent and objective review of the updated project design document (PDD). The updated PDD is reviewed against Kyoto Protocol requirements, UNFCCC rules and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology ACM0001 (19.0).

Validation process

This report summarizes the findings from the validation of the updated PDD of the project, performed on the basis of UNFCCC criteria for CDM, as well as criteria given by the CDM Validation and Verification Standard for project activities, CDM Project Cycle Procedure for project activities and CDM Project Standard for project activities and included an assessment of: (a) The impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period at the time of requesting renewal of crediting period; (b) The correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions from the applicable crediting period. This validation opinion is also to be seen in conjunction with the validation report at the time of requesting registration for the first crediting period. The Validation Opinion is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

Conclusion

Vital Engenharia Ambiental S.A. has commissioned KBS Certification Services Pvt. Ltd. to perform the validation for renewal of the crediting period of the registered project activity "Macaúbas Landfill Gas Project" in Brazil (hereafter called "the project"). In conclusion, it is KBS's opinion that the project meets all the relevant requirements for the renewal of the crediting period.

SECTION B. Validation team, technical reviewer and approver

B.1. Validation 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	Interview(s)	Validation findings
1.	Team Leader/ Technical Expert (1.2, 13.1) Local Expert	EI	Leiroz	Andrea	Central Office	✓		✓	✓

B.2. Technical reviewer and approver of the validation report for RCP

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 (TA 1.2, 13.1)	IR	Badaya	Rohit	Central office
2.	Manager Technical & Certification	IR	Nanda	Madhuri	Central office
3.	Authorizer	IR	Goyal	Kaushal	Central office

SECTION C. Means of validation

C.1. Desk/document review

The report is based on the assessment of the project design document version 6 and subsequent versions 8,9, 10 and 11 /2/, application of standard auditing techniques including but not limited to desk review, follow up actions (e.g., remote audit, electronic (telephone or e-mail) interviews) and also the review of the applicable approved methodological and relevant tools, guidance and CDM decisions.

All the documents used for arriving validation conclusion are listed in Appendix 03 and referenced accordingly in validation report.

C.2. On-site inspection

~~**Duration of on-site site inspection**: DD/MM/YYYY~~				
~~**No.**~~	~~**Activity performed on-site**~~	~~**Site location**~~	~~**Date**~~	~~**Team member**~~
~~1.~~				

As result of the COVID-19 pandemic, taking into account the rules of relevant national and local authorities (local to the DOE offices as well as to locality of the site visits), World Health Organization (WHO) recommendations, policies of the DOE and other relevant travel restrictions and guidance (for example, a requirement to self-isolate upon return from specific countries), the DOE has skipped the on-site visit. However, as per the CDM EB, the DOE may use other standard auditing techniques for validation or verification as referred to in sections 7.1.3 and 9.1.3 of the VVS-PA /12/.
As per para 30 of CDM Validation and Verification Standard for project activities version 02.0 /12/, Validation team has used the following alternative means for its assessment and to justify that they are sufficient for the purpose of validation. Along with desk review, audit team has conducted remote audit interview as follows:

- A complete desk review of the submitted PDD (version 6) /2/ and supportive evidences have been checked by the Validation Team.
- Validation team has performed a remote site inspection via videoconference (Skype) with PP on different topics as mentioned under section C.3 of this report.
- By taking follow up actions by conducted interview with PP, to gather information about knowledge of project design, current situation via videoconference. Cross-checked evaluation under the scope of all information and references provided in PDD. Details of interviewees, topics covered and additional information presented in the below section "C.3 – Interviews".

Validation team has also checked the site visit requirements mentioned in the VVS for Project Activity version 02.0 /12/ and concluded that no site visit is required. The justification for not conducting the on-site visit ras per VVS PA version 02.0 /12/ have been mentioned below.

VVS PA version 02.0 requirements	Validation team justification
Para 29 (b) (b) Follow-up actions (e.g. on-site inspection and telephone or e-mail interviews), including: (i) Interviews with relevant stakeholders in the host country, such as personnel with knowledge of the project design and implementation; (ii) Cross checks between the information provided by interviewed personnel (i.e. by checking sources or other interviews) to ensure that no relevant information has been omitted;	Validation team has done the follow-up actions by: 1. Teleconference with PP. Skype was used with video camera function. PP walked in the plant so that the validation team was able to check that the project is installed as described in the PDD. 2. Cross checks between information provided by interviewed personnel (i.e. by checking sources or other interviews) to ensure that no relevant information has been omitted. 3. PP presented during the videoconference all documents related to renewal of the crediting period. 4. The calculations and assumptions made in determining the CERs were reviewed and discussed with PP by videoconference.
Para 30 It is mandatory for the DOE to conduct an on-site inspection at validation for the proposed CDM project activity if: (a) Its estimated annual average of GHG emission reductions or net anthropogenic GHG removals is more than 100,000 t CO_2 eq; or (b) There is pre-project information that is relevant to the requirements for registration of	The validation team has not considered the site visit as mandatory due to the following reasons which are in line with the VVS PA version 02 requirements. 1. The estimated annual average of GHG emission reductions is 445,100 which is more than 100,000 t CO_2 eq. 2. Also there is no pre-project information that is relevant to the requirements for

the project activity and may not be traceable after the registration.	renewal of the CDM project activity and may not be traceable after the renewal. 3. Lastly but not the least, the validation team has conducted a remote on-site audit via video recording interviews to crosscheck information related to baseline, project implementation, monitoring plan. For the proposed project activity, the site visit cannot be postponed since with a delay on the renewal of the crediting period PP will not have time to verify some months of the second crediting period until the end of this year. There is an ERPA /42/ valid for the second crediting period where it is stated that the emission reductions must have been reported in a single Monitoring Report, generated and issued until 31/12/2020. Hence, for the proposed project activity, it is not mandatory to conduct the physical on site is justified.

C.3. Interviews

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Fiche	Henrique	Director, Asja Brasil	27/04/2020	• Project description • Baseline • Emission reduction calculation • Monitoring plan	Andrea Leiroz
2.	Sprovieri	João	Consultor, Beng	27/04/2020	• Project description • Baseline • Emission reduction calculation • Monitoring plan	Andrea Leiroz
3.	Alvim	Riordan	Landfill Manager, Macaúbas Meio Ambiente S/A	27/04/2020	• Project description • Emission reduction calculation • Monitoring plan	Andrea Leiroz
4.	Loschi	Igor	Plant Manager, Asja Brasil	27/04/2020	• Monitoring plan • Environmental licenses	Andrea Leiroz

C.4. Sampling approach

Not applicable for this project activity.

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

Area of validation findings	No. of CL	No. of CAR	No. of FAR
Compliance with PDD form	-	-	-
Application and selection of methodologies and standardized baselines	-	-	-
Validity of original baseline or its update	-	-	-
Estimated emission reductions or net anthropogenic removals	01	02	-
Validity of monitoring plan	-	01	-
Crediting period	-	-	-
Project participants	-	-	-
Post-registration changes	-	-	-
Others (please specify)	-	-	-
Total	01	03	-

SECTION D. Validation findings

D.1. Compliance with PDD form

Means of validation	PDD applies the applicable CDM-PDD-FORM: Project design document form version 11.0 /15/. KBS verified that the renewal crediting period, information transferred to the later valid version of the PDD form is materially the same as that in the registered PDD /1/.
Findings	N/A
Conclusion	Validation team confirms that final PDD is completed using the valid version of the applicable CDM-PDD-FORM: Project design document form version 11.0 /15/ in compliance with para 412 (a) (i) of VVS for PA version 02 /12/. All the information has been correctly transferred from registered PDD to the current PDD which is filled in the latest CDM PDD form available in UNFCCC website. Validation team confirms that the transfer of information from the old form to the new form is correct and materially the same as the information in the registered PDD in compliance with para 412 (a) (ii) of VVS for PA version 02 /12/. PDD is in compliance with the instruction provided in the template.

D.2. Application and selection of methodologies and standardized baselines

Means of validation	The project was originally registered based on ACM0001 version 1 /43/ however, a PRC was submitted and the methodology version was updated to version 19.0 – "Flaring or use of landfill gas" /16/. For the renewal of crediting period, the submitted revised CDM-PDD (version 11 dated 04/09/2020) /2/ correctly applies the latest version of the methodology, i.e. version 19.0 – "Flaring or use of landfill gas" /16/. Therefore, the project was validated against ACM0001 version 19.0 /16/ requirements, as described in the following sections. **Application of selected baseline and monitoring methodology** The purpose of the project activity is the implementation of a landfill gas collection system to flare and utilize LFG for producing electricity at the Macaúbas Landfill Gas Project. As described in the PDD /2/, the Macaúbas landfill started its operations in November 2005 and has an operational lifetime of 25 years /5/. During the operation of the landfill the captured LFG was only vented and partially flared in open flares and not used prior to the implementation of the project activity. KBS confirmed that the project is currently capturing the LFG and sending it to an enclosed flare and for electricity production. The methodology ACM0001 (version 19.0) /16/ is applicable to the project as this project consists of the implementation of a landfill gas collection system to flare and utilize LFG for producing electricity at the Macaúbas Landfill Gas Project. The applied baseline methodology is justified as it has been demonstrated that the project activity ensures that: (a) A new LFG capture system was installed in an existing SWDS;

(b) An investment was made into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that:

(i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and

(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.

An investment was made to increase the recovery rate (collection efficiency) and to change the use of the captured LFG since prior to the implementation of the project activity the captured LFG was only vented and partially flared in open flares.

(c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:

(i) Generating electricity;

(ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or

(iii) Supplying the LFG to consumers through a natural gas distribution network;

(iv) Supplying compressed/liquefied LFG to consumers using trucks;

(v) Supplying the LFG to consumers through a dedicated pipeline;

LFG is flared and used to generate electricity as confirmed during the remote site visit (by videoconference) and follow-up interview.

(d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.

PP provided a declaration /9/ confirming that there is no recycle center for the organic material in the landfill. In addition, recycling of organic waste is not part of the operational procedures of the landfill. Thus, the amount of organic waste that would be recycled in the absence of the project activity will not be reduced.

The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:

(a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and

(b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln:

(i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and or

(ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary;

(c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.

(d) In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

The baseline scenario is released the LFG to atmosphere from the SWDS, and the electricity would be generated in the grid connected power plants. For more details, please refer to step 1 of Section D.3 where KBS confirmed that the atmospheric release of the LFG is still the current practice for landfills in Brazil. It is not mandatory to flare the landfill gas in Brazil, according to the Brazilian National Policy on Solid Waste /30/, which is the only law that regulates the solid waste management and final destination. There are no policies or regulations in Brazil that require landfill gas capture or destruction other than for technical safety issues /30/. Regarding electricity generation in existing and/or new grid-connected power plants, there are no new rules or legislations in Brazil that go against the previous established baseline i.e. electricity could continue to be generated by the plants feeding the grid.

	The methodology ACM0001 (version 19.0) /16/ is applicable since: (a) The proposed project activity does not apply any other CDM approved methodology. ACM0001 is not used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace /2/; (b) The management of the SWDS in the project activity is not changed to meet a technical or regulatory requirement during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity. The "Tool to calculate the emission factor for an electricity system" version 07.0 /22/ is used since the project will supply electricity to the local grid and will consume electricity from the grid for internal use. The tool "Emissions from solid waste disposal sites" version 08.0 /19/ is used in order to calculate project's baseline emissions for *ex-ante* estimations purposes. The actual baseline emissions will be monitored. The "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 03.0 /18/ will not be used since there will be no consumption of fossil fuel in project case as KBS could verify by reviewing the project's licenses /7/ /8/ and during the remote visit at the site. The tool "Project emissions from flaring" version 03.0 /21/ is used in order to establish the calculations of the methane destruction efficiency of the enclosed flare and the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0 /23/ is used in order to establish the monitoring procedures and calculations of the methane flows sent to flaring and electricity generation. The "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /20/ is used for calculating project emissions when electricity from the grid is being consumed. The tool "Determining the baseline efficiency of thermal or electric energy generation systems" (Version 02.0) /24/ will not be used since there is no thermal energy or electricity generation units in the baseline scenario. The "Tool to determine the remaining lifetime of equipment" (Version 01) /25/ will not be used since the project activity does not involve the replacement of existing equipment with new equipment or which retrofit existing equipment as part of energy efficiency improvement activities. The tool "Project and leakage emissions from transportation of freight" (Version 01.1.0) /27/ will not be used since the project activity does not involve freight transportation by road. The tool "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 07.0) /17/ will not be used to identify the baseline scenario since the project is renewing the crediting period and thus, the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" (Version 03.0.1) /26/ is used in order to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism. The tool "Positive lists of technologies" (version 01.0) /28/ is not used to demonstrate additionality applying the simplified procedure.
Findings	N/A
Conclusion	The compliance of those applicability conditions was confirmed during the remote audit, through the review of documentation, interviews and based on its sectoral knowledge. The assessment of the project's compliance with the applicability criteria of ACM0001 (version 19.0) are documented in detail above. Hence use of the selected methodology is appropriate for this project activity compliance with para 412 (a) (iii) of VVS for PA version 02 /12/.

D.3. Validity of original baseline or its update

Means of validation	The following steps from the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" /26/ as per CDM-EB "Validation and Verification Standard for project activities" (version 02.0) /12/ were applied:

	Step 1: Assess the validity of the current baseline for the next crediting period The "CDM Project Standard for project activities" /13/ requires assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps: **Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies** KBS has confirmed that no relevant mandatory national and/or sectoral polices applicable to the project activity came into effect after the submission of the project activity for validation. For the baseline scenario LFG2: Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons. It is not mandatory to flare the landfill gas in Brazil, according to the Brazilian National Policy on Solid Waste /30/, which is the only law that regulates the solid waste management and final destination. There are no policies or regulations in Brazil that require landfill gas capture or destruction other than for technical safety issues /30/. The environmental permit granted by the environmental agency SEMAD (Minas Gerais State Secretary of Environment and Sustainable Development) /7/ to the landfill does not mention landfill gas capture and/or destruction among the mandatory applicability conditions. For the baseline scenario E3: Electricity generation in existing and/or new grid-connected power plants. There are no new rules or legislations in Brazil that go against the previous established baseline i.e. electricity could continue to be generated by the plants feeding the grid. The electricity generation through renewable sources by independent producers is regulated by the National Electric Agency (ANEEL) and hence, the alternative is in compliance with the national laws on energy production with LFG. This can be verified by KBS with the authorization for electricity generation issued by ANEEL to Asja Sabará Serviços para o Meio Ambiente S/A /11/. The project participant has stated in PDD that there was no use of any fossil fuel before implementation of the project activity and the electricity is provided by the national grid. KBS was able to verify the validity of this information through the registered PDD /1/ and validation report /4/. For the second crediting period, the project complies with national requirements: The National Electric System Operator (ONS from the Portuguese Operador Nacional do Sistema Elétrico) /36/; The Electricity Regulatory Agency ("ANEEL" from the Portuguese Agência Nacional de Energia Elétrica) /39/; The Mines and Energy Ministry ("MME" from the Portuguese Ministério de Minas e Energia) /37/; The Chamber of Electrical Energy Commercialization ("CCEE" from the Portuguese Câmara de Comercialização de Energia Elétrica) /38/. Thus, it is concluded that no relevant national and/or sectorial policies affected the validity of the project activity baseline. **Step 1.2: Assess the impact of circumstances** There are no new national/sectoral polices/legislation/circumstances that could affect the baseline scenario during the renewal of the crediting period. KBS confirmed that the atmospheric release of the LFG is still the current practice for landfills in Brazil. **Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested** The continuation of atmospheric release of the LFG only destroying a small percentage to address safety and odour concerns is technically possible, since it is a simple management system that requires minor maintenance. For the electricity generation, in the absence of the project activity, the electricity would be generated by the grid connected power plants. Thus, this sub-step should not be applied since the baseline scenario identified at the validation of the project activity would be a more financial attractive scenario than the project activity without CDM. **Step 1.4: Assessment of the validity of the data and parameters** The only parameter not monitored during the crediting period that needed to be updated based in ACM0001 version 19.0 /16/ requirements and tools /17/ - /28/ is

	$EF_{grid,BM,y}$. This parameter is properly described in the following section D.5. The other parameters updated were monitored parameters. **Conclusion on step 1** KBS confirms that the current baseline is still valid as per methodology ACM0001 (version 19.0) /16/ for the second crediting period. **Step 2: Update the current baseline and the data and parameters** **Step 2.1: Update the current baseline** The baseline emissions for the second crediting period have been updated, without reassessing the baseline scenario, based on the latest approved version of methodology ACM0001 /16/. **Step 2.2: Update the data and parameters** The parameters described under step 1.4 were properly updated considering the latest versions of ACM0001 /16/ and tools /17/ - /28/.
Findings	N/A
Conclusion	Validity of the baseline has been correctly assessed and the parameters are updated as per the Methodology Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" /26/ in the PDD submitted for the renewal of crediting period.

D.4. Estimated emission reductions or net anthropogenic removals

Means of validation	**Algorithms and/or formulae used to determine emission reductions** The various algorithm/formulae for calculating baseline and project emissions have been transparently documented in line with the requirements of ACM0001 version 19.0 /16/. Baseline emissions: Baseline emissions are estimated as the amount of methane that would have been destroyed/combusted during the year in project scenario ($BE_{CH4,y}$) and the net quantity of electricity produced using LFG times CO_2 emissions intensity of the baseline source of electricity displaced ($BE_{EC,y}$). No thermal energy is produced and no LFG is supplied to natural gas network as can be verified during the remote audit and in the documentation sent for operation license request of the electricity generation /7/ /8/. The methane from the Macaúbas landfill ($BE_{CH4,y}$) baseline emissions is given by the formula: $$BE_{CH4,y} = \left(1 - OX_{top-layer}\right) * \left(F_{CH4,PJ,y} - F_{CH4,BL,y}\right) * GWP_{CH4}$$ The fraction of methane that would be oxidized in the top layer of the SWDS in the baseline (OX_{top_layer}) of 0.1 is according to the ACM0001 recommendations /16/. As stated in the PDD /2/, there are no regulatory requirements on LFG capture and flaring. Following Table 3 of methodology ACM0001, there is no requirement to destroy methane as explained in section D3 of this report. However, during the operation of the landfill the captured LFG was only vented and partially flared in open flares and not used prior to the implementation of the project activity. Thus, there was an existing LFG capture and destruction system despite there is no obligation to destruct methane and such destruction was not monitored. As a consequence, the amount of methane in the LFG that would be flared in the baseline in year *y* ($F_{CH4,BL,R,y}$) is 20% of the amount of methane in the LFG which is flared and/or used in the project activity in year *y* ($F_{CH4,PJ,y}$) as resulted in the application of Case 3 in Step A.2 of the methodology ACM0001 version 19.0 /16/. For the *ex-ante* estimation, the amount of methane in the LFG which is flared and/or used in the project activity in year *y* ($F_{CH4,PJ,y}$) was estimated annually according the "Emissions from solid waste disposal sites*"* version 08.0 /19/. The $BE_{CH4,SWDS,y}$ (amount of methane in the LFG that is generated from the SWDS in the baseline scenario in the year y) is calculated as per the Application A of the tool considering the daily amount of waste dumped and future entrances /5/ and the waste composition /6/ and is according to the tool "Emissions from solid waste disposal sites*"* version 08.0 /19/. The efficiency of the LFG capture system installed in the project activity (η_{PJ}) is estimated to be 65% according to the Feasibility Study /32/ /35/. KBS has verified the calculation of $BE_{CH4,SWDS,y}$ and assumptions and evidences are correctly applied. For the *ex-post* determination, the amount of methane in the LFG which is flared and/or used in the project activity in year *y* ($F_{CH4,PJ,y}$) is determined by monitoring the

	quantity of methane actually flared and gas used to generate electricity. No thermal energy is produced and no methane is sent to the pipeline for feeding to the natural gas distribution network. The amount of methane in the LFG which is destroyed by flaring in year *y* ($F_{CH4,flared,y}$) is determined based on quantity of landfill gas sent to the flare ($F_{CH4,sent\_flare,y}$) and the project emissions from flaring of the residual gas stream ($PE_{flare,y}$), calculated according to the "Project emissions from flaring", version 03.0 /21/. The amount of methane in the LFG which is sent to the flare in year *y* ($F_{CH4,sent\_flare,y}$) is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /23/. As described in the PDD, Option A (volume flow and volumetric fraction measured in dry basis) is selected for the calculation. However, during the project operational monitoring, if not demonstrated that the temperature of the gaseous stream (T_t) is less than 60ºC (dry basis), then the flow measurement should be assumed to be on a wet basis and the option B should be applied instead. The flare efficiency of the enclosed flare is 80% as per Option A of the "Project emissions from flaring", version 03.0 /21/. The baseline emissions associated with the electricity generation in year *y* ($BE_{EC,y}$) is calculated as per the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /20/. Project participant choose Scenario A (Electricity consumption from the grid), Option A.1 where the combined margin emission factor of the applicable electricity system is determined using the procedures in the "Tool to calculate the emission factor for an electricity system" version 07.0 /22/. The net amount of electricity generated using LFG in year y ($EC_{BL,k,y}$) was calculated according to the installed power of each generator of 1.426 MW and the total generators working hours (7,884 hours). The net quantity of electricity is the total electricity generated and delivered to the grid since the project internal consumption will continue to use electricity from the grid. The emission factor for electricity generation for source *k* in year *y* ($EF_{EL,k,y}$) was calculated according to "Tool to calculate the emission factor for an electricity system" /22/. For the *ex-ante* estimation of emissions reduction, the electricity generated is estimated to be 32 898 MWh in the first year up to 78 698 MWh in the six subsequent years and 45 494 MWh in the last year of the second crediting period, according to the spreadsheet /3/. KBS is able to confirm that the most recent information available by the Brazilian DNA (2018) /34/ was used to determine the baseline emission factor of 0.2375 tCO_{2e}/MWh since the PDD was submitted on 10 April 2020 for starting the validation. The dispatch data analysis was the option selected for the calculation of the operating margin (OM). The build margin (BM) emission factor will be determined applying Option 2. However, for the second crediting period, the build margin factor should be calculated *ex-ante* based on the most recent information available at the time of submission of the request for renewal of the crediting period to the DOE. According to the monitoring procedures established by the "Tool to calculate the emission factor for an electricity system" /22/, the emission factor will be determined for the year in which the project displaces the grid electricity. If data to calculate the emission factor is not available, the emission factor from the previous year (y-1) may be used. If data available is older than 18 months, than the emission factor to be used will be for year y-2. Monitoring procedures are correctly applied by the project participant. Based on 2018 data available at the time of submission of the request for renewal of the crediting period, OM emission factor was estimated to be 0.5390 tCO_{2e}/MWh and the BM was determined to be 0.1370 tCO_{2e}/MWh /22/ /34/. As a result, the combined margin (CM) emission factor used for estimating purposes of the emission reductions in the PDD is 0.2375 tCO2e/MWh, based on 0.25:0.75 weighting between OM and BM emission factor fixed for the second crediting period /22/. <u>Project emissions:</u> Project emissions are estimated as the emissions from consumption of electricity from the grid due to the project activity in year y ($PE_{EC,y}$). No fossil fuel is consumed for purpose other than electricity generation and no LFG is distributed using trucks or supplied to consumers through a dedicated pipeline as can be verified during the remote site visit. Emissions from consumption of electricity ($PE_{EC,y}$) are calculated following the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /20/.

The emissions from electricity consumption are estimated based on the amount of electricity consumed by the project activity $EC_{PJ,j,y}$ times the emission factor for electricity generation and transmission and distribution losses. A value for TDL_y of 26.3% /40/ is considered as per National Energy Balance. KBS confirmed that this is the most recent data available and is in accordance with provisions in table 3 of the section 7.2 of Tool 05: "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /20/. The parameter will be monitored annually according to the same tool. The amount of electricity consumed by the project activity is estimated to be 3,742 MWh per year of the second crediting period, based on the electricity demand of main components (blower, chillers, air-conditioner of equipment house) and operation offices /10/. KBS has assessed the values and cross checked with the equipment specified in the project LFG system and found to be correct.
No leakage effects need to be accounted under the methodology used.
However, experiences with other landfills have shown that the methane generation and collection efficiency of the landfills projected by the first order decay model has an inherent uncertainty of almost 50% and hence the amount of CERs, which will be monitored *ex-post*, might vary from the projected amount. No other project emission or leakage sources contributing more than 1% and not mentioned by the methodology have been found.
Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average *ex-ante* estimation of emission reduction calculated to be 1,030 tCO_2e per year for the selected crediting period.

Estimation of GHG emissions
Emission reductions are directly monitored and calculated *ex-post*, using the approach indicated in the methodology ACM0001 version 19.0 /16/.
Baseline emissions:
As explained above, baseline emissions are estimated as the amount of methane that would have been destroyed/combusted during the year in project scenario ($BE_{CH4,y}$) and the net quantity of electricity produced using LFG times CO_2 emissions intensity of the baseline source of electricity displaced ($BE_{EC,y}$).
For the *ex-ante* estimation, the amount of methane in the LFG which is flared and/or used in the project activity in year *y* ($F_{CH4,PJ,y}$) is estimated to be:

Year	$F_{CH4,PJ,y}$ (tCH_4/yr)
From 31/07/2020	8,929
2021	22,077
2022	22,706
2023	23,272
2024	23,792
2025	24,279
2026	24,741
Until 30/07/2027	14,559

The annual estimation results are presented in the spreadsheet /3/. The $BE_{CH4,SWDS,y}$ (amount of methane in the LFG that is generated from the SWDS in the baseline scenario in the year y) is calculated as:

Year	$BE_{CH4,SWDS,y}$ (tCO_2/yr)
From 31/07/2020	343,412
2021	849,134
2022	873,318

2023	895,066
2024	915,069
2025	933,803
2026	951,593
Until 30/07/2027	559,970

KBS has verified the calculation of $BE_{CH4,SWDS,y}$ and assumptions and evidences are correctly applied /3/.
For the *ex-ante* estimation, the amount of methane in the LFG that would be flared in the baseline in year *y* ($F_{CH4,BL,y}$) is estimated to be:

Year	$F_{CH4,BL,y}$ (tCH_4/yr)
From 31/07/2020	1,786
2021	4,415
2022	4,541
2023	4,654
2024	4,758
2025	4,856
2026	4,948
Until 30/07/2027	2,912

The amount of methane in the LFG which is destroyed by flaring in year *y* ($F_{CH4,flared,y}$) is determined based on quantity of landfill gas sent to the flare ($F_{CH4,sent\_flare,y}$) and the project emissions from flaring of the residual gas stream ($PE_{flare,y}$), calculated according to the "Project emissions from flaring", version 03.0 /21/. The amount of methane in the LFG which is sent to the flare in year *y* ($F_{CH4,sent\_flare,y}$) is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0 /23/. As described in the PDD, Option A (volume flow and volumetric fraction measured in dry basis) is selected for the calculation. The burning efficiency in the enclosed flare of 80% is considered as per Option A of the "Project emissions from flaring", version 03.0 /21/.
Thus, baseline emissions of methane from the SWDS are estimated as:

Year	$BE_{CH4,y}$ ($tCO_2/year$)
From 31/07/2020	160,717
2021	397,395
2022	408,713
2023	418,891
2024	428,252
2025	437,020
2026	445,346
Until 30/07/2027	262,066

For the *ex-ante* estimation, the net amount of electricity generated using LFG in year *y* ($EC_{BL,k,y}$) is estimated to be:

Year	Electricity generated in the plant (MWh)

From 31/07/2020	32,898
2021	78,698
2022	78,698
2023	78,698
2024	78,698
2025	78,698
2026	78,698
Until 30/07/2027	45,494

Based on 2018 data available at the time of submission of the request for renewal of the crediting period, OM emission factor was estimated to be 0.5390 tCO2e/MWh and the BM was determined to be 0.1370 tCO2e/MWh /34/. As a result, the combined margin (CM) emission factor used for estimating purposes of the emission reductions in the PDD is 0.2375 tCO2e/MWh.
The baseline emissions associated with electricity generation was estimated as:

Year	$BE_{EC,y}$ (tCO_2/yr)
From 31/07/2020	9,869
2021	23,608
2022	23,608
2023	23,608
2024	23,608
2025	23,608
2026	23,608
Until 30/07/2027	13,647

Thus, the total baseline emissions are estimated in:

Year	BE_y (tCO_2/yr)
From 31/07/2020	170,586
2021	421,002
2022	432,321
2023	442,498
2024	451,860
2025	460,627
2026	468,953
Until 30/07/2027	275,713

Project emissions:
Project emissions are estimated as the emissions from consumption of electricity from the grid due to the project activity in year y ($PE_{EC,y}$).
The emissions from electricity consumption are estimated based on the amount of electricity consumed by the project activity ($EC_{PJ,j,y}$) times the grid emission factor and transmission and distribution losses. A value for $EF_{EL,j,y}$ of 0.2375 tCO_2/MWh and for TDL_y of 20% is considered as per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /20/. The amount of electricity consumed by the project activity is estimated to be 3,742 MWh per year of the second crediting period, based on the electricity demand of main components (blower, chillers, air-conditioner of equipment house) and operation offices /10/.

	There is no consumption of fossil fuels for purpose other than electricity generation in year y, therefore $PE_{FC,y} = 0$. Thus, the total project emissions are estimated in: **Year** / **PE_y (tCO_2/yr)** From 31/07/2020: 470 2021: 1,123 2022: 1,123 2023: 1,123 2024: 1,123 2025: 1,123 2026: 1,123 Until 30/07/2027: 649 Leakage emissions: No leakage effects need to be accounted under the methodology used. The project activity is estimated to result in 445,100 tCO_2e per year of emission reductions annually throughout the 7-year renewable crediting period.
Findings	CL-01, CAR-01 and CAR-02 were raised and successfully closed. The findings are discussed in Appendix 04 of the validation report.
Conclusion	The assessment team confirms that: • All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources; • All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD; • All values used in the PDD are considered reasonable in the context of the proposed CDM project activity; • The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions; • All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD. It is KBS's opinion, that the project participants are able to implement the monitoring plan in compliance with para 412 (a) (iv) of VVS for PA version 02 /12/.

D.5. Validity of monitoring plan

Means of validation	The project applies the approved monitoring methodology ACM0001 (version 19.0) –Flaring or use of landfill gas /16/. The project monitoring plan is in compliance with the monitoring methodology ACM0001 (version 19.0) /16/. Parameters determined ex-ante The following parameters are made available *ex-ante*: According to ACM0001 version 19.0 /16/: - The fraction of methane that would be oxidized in the top layer of the SWDS in the baseline (OX_{top_layer}) of 0.1 is according to the ACM0001 /16/; - The GWP_{CH4} (global warming potential - GWP) of 25 for the methane gas is correctly applied according to IPCC2006 values /29/ /33/; - The $\eta_{P,J}$ (efficiency of the LFG captured system that will be installed in the project activity) of 65% is correctly applied according to ACM0001 version 19.0 /16/. According "Emissions from solid waste disposal sites" version 08.0 /19/: - The φ (default value for the model correction factor to account for model uncertainties), the value correctly applied 0.75 for the SWDS located in humidity/wet climate according mean annual temperature (21.1°C) and

mean annual precipitation (1 490 mm) – wet climate /31/. Value chosen is according to the "Emissions from solid waste disposal sites" version 08.0 /19/ and was confirmed by KBS;

- OX (oxidation factor), value correctly applied 0.1 for solid waste disposal sites that are covered with oxidizing material such as soil or other material, KBS has verified during the remote audit conducted that it is covered with soil;
- F (fraction of methane in the SWDS gas), the value correctly applied 0.5 according to "Emissions from solid waste disposal sites" version 08.0 /19/;
- $DOC_{f,default}$ (default value for the fraction of degradable organic carbon (DOC) in MSW that can decompose in the SWDS), the value correctly applied 0.5 according to the "Emissions from solid waste disposal sites" version 08.0 /19/;
- $MCF_{default}$ (methane correction factor), value correctly applied 1.0 is used for anaerobic managed solid waste disposal sites that have controlled placement of waste as per IPCC 2006 Guidelines /33/;
- DOC_j (fraction of degradable organic carbon (by weight) in the waste type *j*), values correctly applied for wet waste according to IPCC 2006 Guidelines /33/. The values applied are:

Waste type *j*	**DOC_j (% wet waste)**
Wood and wood products	43
Pulp, paper and cardboard	40
Food, food waste, beverages and tobacco	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

- k_j (decay rate for the waste type j): values applied according mean annual temperature (21.1°C) and mean annual precipitation (1 490 mm) – wet climate. Climate data was confirmed by KBS /31/. The values used are:

Waste type *j*		**k_j**
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles	0.07
	Wood, wood products and straw	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco.	0.4

- f_y: Fraction of methane captured at the SWDS and flared, combusted or used in another manner. Value 0 is correctly applied as per recommendations of ACM0001 version 19.0 /16/;
- Waste composition: The fraction of waste type is according to the landfill internal studies provided by the project participant /6/. There is a change in the waste composition when compared to the last PDD. The reasons are related to increase of population served by the landfill, variation in the income of the population served, which increases or decreases the percentage of organic waste in the trash. The values were verified by KBS and are:

Composition of waste	
A) Wood and wood products	0.38%
B) Pulp, paper and cardboard (other than sludge)	11.72%

C) Food, food waste, beverages and tobacco (other than sludge)	52.23%
D) Textiles	0.77%
E) Garden, yard and park waste	0.00%
F) Glass, plastic, metal, other inert waste	34.90%
TOTAL	**100.00 %**

According to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0 /23/:

- MM_i: The molecular mass of greenhouse gas methane is 16.04 kg/kmol is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /23/ application criteria as the methane is the greenhouse gas considered and the remaining gases are pure nitrogen for simplification.
- MM_k: The molecular mass of greenhouse gas nitrogen is 28.01 kg/kmol is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /23/ application criteria as the methane is the greenhouse gas considered and the remaining gases are pure nitrogen for simplification.
- MM_{H20}: The molecular mass of water is 18.0152 kg/kmol is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /23/ application criteria as the methane is the greenhouse gas considered and the remaining gases are pure nitrogen for simplification.

According to the "Project emissions from flaring" version 03.0 /21/:

- R_u: The universal ideal gases constant used is 8 314 $Pa.m^3/kmol.K$ is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /23/;
- $SPEC_{flare}$: The manufacturer's flare specifications for temperature is 1 200°C (maximum), for flow rate is from 2 500 Nm^3/h (maximum) and for maintenance schedule is 7 days as per internal procedures.

According to the "Tool to calculate the emission factor for an electricity system" version 07.0 /22/:

- $EF_{grid,BM,y}$ (build margin emission factor of the Brazilian grid) the value correctly applied 0.1370 tCO2e/MWh based on the most recent information available at Brazilian DNA /34/ at the time of submission of the request for renewal of the crediting period.

Parameters monitored ex-post:

The monitoring plan allows for collection and archiving of the following key parameters related to the determination of emission reductions resulting from the project activity:

According to ACM0001 version 19.0 /16/:

- Management of SWDS will be monitored annually;
- $O_{pj,h}$: Operation of the equipment that consumes the LFG: Operation of the flare will be measured every minute by flame detector. No value is expected for the purpose of *ex-ante* emission reduction calculations. The calibration is not applicable since it is a device integrated with the operational software at the landfill gas plant;
- $EG_{PJ,y} = EC_{BL,k,y}$: Amount of electricity generated using LFG by the project activity in year *y* will be measured continuously by an electricity meter. The electricity meter will be calibrated according to manufacturer's specification. The values applied for the purpose of calculating *ex-ante* emission reduction were verified by KBS and are correct. The electricity generation readings will be double checked by the electricity distribution company.

Following the options and procedures of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /23/ and the methodology

ACM0001 version 19.0 /16/, project participants had opted for assuming that the gaseous stream will be methane and the remaining gas is pure nitrogen. In order to check if the assumptions are fulfilled during the monitoring, the temperature of the gas near the flow meter will be continuously measured in order to guarantee that the temperature will be below 60°C. Therefore, the parameters to be monitored, in order to calculate the amount of methane in the LFG which is sent to the flare, are:

- $V_{t,db}$: Volumetric flow of the gaseous stream in time interval *t* on a dry basis (m^3/h). The flow will be measured with a flow meter. There will be a flow meter installed for each component of the project i.e., for each flare line and each electricity generators line. The flow will be measured continuously and data will be hourly aggregated. The flow meter's will be calibrated according to manufacturer's recommendations. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations;
- $V_{t,wb}$: Volumetric flow of the gaseous stream in time interval *t* on a wet basis (m^3/h). The flow will be measured with a flow meter. There will be a flow meter installed for each component of the project i.e., for each flare line and each electricity generators line. The flow will be measured continuously and data will be hourly aggregated. The flow meter's will be calibrated according to manufacturer's recommendations. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations;
- $v_{i,t,db}$: Volumetric fraction of greenhouse gas *i* in a time interval *t* in a dry basis the value correctly applied 50% according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /23/. The methane gas fraction will be measured continuously by an on-site gas analyser and data will be hourly aggregated. The equipment will be calibrated according to manufacturer's recommendations. The calibration involves a zero check with an inert gas (nitrogen) and verification with a bottled standard gas;
- $v_{i,t,wb}$: Volumetric fraction of greenhouse gas *i* in a time interval *t* in a wet basis the value correctly applied 50% according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /23/. The methane gas fraction will be measured continuously by an on-site gas analyser and data will be hourly aggregated. The equipment will be calibrated according to manufacturer's recommendations. The calibration involves a zero check with an inert gas (nitrogen) and verification with a bottled standard gas. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations;
- T_t: temperature of the gaseous stream in time internal *t*. The temperature of the landfill gas will be measured by an instrument with recordable electronic signal in order to guarantee that gas temperature at the point of flow measurement is not above 60°C, as per the conditions to adopt dry basis calculations. Nonetheless, temperature will be monitored continuously. The equipment will be calibrated according to manufacturer's recommendations.
- P_t: Pressure of the gaseous stream in time interval *t*. The pressure of the gaseous stream will be measured by an instrument with recordable electronic signal. The equipment will be calibrated according to manufacturer's recommendations. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations.
- Status of biogas destruction device: Operational status of biogas destruction devices. Continuous monitoring and documenting may be undertaken by recording the energy production from methane captured or the operation of the flare by means of a flame detector to demonstrate the actual destruction of methane.
- $P_{H2O,t,Sat}$: Saturation pressure of H_2O at temperature T_t in time interval t. This parameter is solely a function of the gaseous stream temperature T*t* and can be found at reference [1] of the "Tool to determine the mass flow of a

greenhouse gas in a gaseous stream", version 03.0 /23/ for a total pressure equal to 101 325 Pa.

According to the "Project emissions from flaring", version 03.0 /21/:

- $T_{EG,m}$: Temperature in the exhaust gas of the enclosed flare in minute *m* will be measured once per minute by thermocouple type N, as per the tool recommendations /21/. No value is expected for the purpose of *ex-ante* emission reduction calculations. The thermocouple will be calibrated once a year.
- $Flame_m$: Flame detection of flare in the minute *m* will be measured once per minute by an ultra violet flame detector. No value is expected for the purpose of *ex-ante* emission reduction calculations. The optical flame detector will be calibrated as per manufacturer's specification.
- $Maintenance_y$: Maintenance events completed in year *y* will be measured annually and kept in a maintenance log for two year beyond the life of the flare. No value is expected for the purpose of *ex-ante* emission reduction calculations. The dates should be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer.

A 80% value for the flare efficiency is considered for the *ex-ante* estimations of emission reductions as per the tool "Project emissions from flaring", version 03.0 /21/.

According to "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", version 03.0 /20/:

- $TDL_{j,y}$: Average technical transmission and distribution losses for providing electricity to source *j* in year *y*. A value of 26.3% is chosen as per National Energy Balance /40/. The parameter will be monitored annually according to the same tool.
- $EG_{EC,y} = EC_{PJ,j,y}$: Quantity of electricity consumed from the grid by the project activity during the year *y* will be measured continuously by an electricity meter. The parameter will be measured by an electricity meter owned by the local grid administration and electricity distribution company. The data will be obtained with the electricity bills with monthly aggregated values. The electricity meter will be calibrated by the local electricity distributor company, according to the local regulations, since the meters are tamper- proof. The equipment maintenance will be of responsibility of the electricity distribution company, since the project participant has no access to manipulate the equipment. The values applied for the purpose of calculating ex-ante emission reduction were verified by KBS and are correct.

According to "Tool to calculate the emission factor for an electricity system" version 07.0 /22/:

- $EF_{grid,CM,y}$: The combined margin emission factor will be determined ex-post based on the most recent information available at Brazilian DNA; the detailed calculations of the combined margin emission factor are described in section D.4.
- $EF_{grid,OM,y}$: The operating margin emission factor will be determined ex-post based on the most recent information available at Brazilian DNA; the detailed calculations of the combined margin emission factor are described in section D.4.

Management system and quality assurance
Detailed monitoring procedures, including responsibilities for project management, procedures for QA/QC of monitoring reports and calibration are defined in the PDD. The monitoring plan contains all necessary parameters described in accordance with the monitoring methodology. The monitoring plan, including data management and QA/QC procedures, will give opportunity for real measurements of achieved emission reductions, which can hence be reported *ex-post* and verified. The application of the

	monitoring methodology is transparent and KBS considers the project participants able to implement the monitoring plan.
Findings	CAR-03 was raised and successfully closed. The findings are discussed in Appendix 04 of the validation report.
Conclusion	It is KBS's opinion, that the project participants are able to implement the monitoring plan in compliance with para 412 (a) (iv) of VVS for PA version 02 /12/.

D.6. Crediting period

Means of validation	The second crediting period starts on 31/07/2020, in line with the end of the first crediting period.
Findings	N/A
Conclusion	KBS confirmed that the second crediting period of the registered CDM project activity commences on the day immediately after the expiration of the current crediting period in compliance with para 412 (a) (v) of VVS for PA version 02 /12/.

D.7. Project participants

Means of validation	The involved party is Brazil as the host Party. There is no Annex I Party identified yet. The project participant is Vital Engenharia Ambiental S.A. of Brazil. The Project participant is listed in section A.4 of the PDD and the information is consistent with the contact details in Appendix 1 of the PDD.
Findings	N/A
Conclusion	KBS verified that the project participants included in the updated PDD are consistent with the names of the project participants in the project view page and are the same as 1st crediting period in compliance with para 412 (a) (vi) of VVS for PA version 02 /12/.

D.8. Post-registration changes

Type of post-registration changes (PRCs)	**Confirmation** (Y/N)	**Validation report for PRCs**	
		Version	**Completion date**
Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents[1]	N	NA	NA
Corrections	N	NA	NA
Change to the start date of the crediting period	N	NA	NA
Inclusion of a monitoring plan	N	NA	NA
Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents	Y	Version 01.1Aa	05/02/2020
Changes to the project design	Y	Version 01.1Aa	05/02/2020
Changes specific to afforestation and reforestation project activities	NA	NA	NA

SECTION E. Internal quality control

Following the completion of the assessment process and a recommendation by the assessment team, the validation opinion prepared by Team Leader is independently reviewed by internal Technical Reviewer. TR reviews if all the KBS procedures have been followed and all conclusions are justified in accordance with applicable standards, procedures, guidance and CDM decisions. The TR either is qualified for the technical area within the CDM sectoral scope(s) applicable to project activity or is supported by qualified independent technical expert at this stage.

The Technical Reviewer will either accept or reject the recommendation made by the assessment team. The findings can be raised at this stage and PP must resolve them within agreed timeline.

[1] 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).

The opinion recommended by Technical Reviewer will be confirmed by Manager Technical & Certification and finally authorized by the Managing Director on behalf of KBS as final validation opinion. The Technical Reviewer and Manager T&C maybe be same person.

SECTION F. Validation opinion

KBS Certification Services Pvt. Ltd. has been contracted by 'Vital Engenharia Ambiental S.A.' to perform a validation of the CDM registered project 'Macaúbas Landfill Gas Project (UNFCCC Ref #9063) in Brazil for renewal of crediting period.

The validation was performed in accordance with the UNFCCC criteria for the Clean Development Mechanism, latest version of Validation and Verification Standard for project activities and related Standards/Guidance and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.
The CDM project activity will result in reductions of greenhouse gas (GHG) emissions that are real, measurable and give long-term benefits to the mitigation of climate change. In our opinion, the project meets all relevant UNFCCC, CDM criteria and all relevant host country criteria.
.
The review of the project design documentation and the subsequent follow-up interviews have provided validation team with sufficient evidence to determine the validity of the original baseline and/or its update through an assessment. The project design document (dated 04/09/2020) correctly applies large scale methodology ACM0001 version 19.0. It is demonstrated that the project baseline scenario is not changed and also all necessary parameters are updated correctly for the 2nd crediting period.

The total emission reductions from the project are estimated to be 3,115,703 tCO_2e for the 2nd crediting period during 31/07/2020 to 30/07/2027, averaging 445,100 annually. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achievable given the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project's emission reductions. The monitoring arrangements described in the monitoring plan are feasible within the project design, and it is validation team's opinion that the project participants are able to implement the monitoring plan.

In summary, it is validation team's opinion that the CDM project activity "Macaúbas Landfill Gas Project" (UNFCCC Ref #9063) in Brazil meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence KBS requests the renewal of the crediting period of the project.

Appendix 1. Abbreviations

Abbreviations	Full texts
ANEEL	Agência Nacional de Energia Elétrica (National Electric Agency)
BE	Baseline Emissions
BM	Build Margin
CAR	Corrective Action Request
CCEE	Câmara de Comercialização de Energia Elétrica (The Chamber of Electrical Energy Commercialization)
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	Methane
CL	Clarification request
CM	Combined Margin
CO_2	Carbon dioxide
DNA	Designated National Authority
DOE	Designated Operational Entity
EF	Emission Factor
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
INMET	Integrated Meteorological National Institute
KBS	KBS Certification Services Pvt. Ltd.
LFG	Landfill Gas
MME	Ministério de Minas e Energia (The Mines and Energy Ministry)
OM	Operating Margin
ONS	Operador Nacional do Sistema Elétrico (National Electric System Operator)
PDD	Project Design Document
PE	Project Emissions
PP	Project Participant
PRC	Post registration change
PS	Project Standard
PCP	Project Cycle Procedure
RCP	Renewal of Crediting period
SEMAD	Minas Gerais State Secretary of Environment and Sustainable Development
SWDS	Solid Waste Disposal Site
QA/QC	Quality Assurance/Quality Control
tCO_{2e}	Tonnes of CO_2 equivalents
T&C	Technical & Certification
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation & Verification Standard

Appendix 2. Competence of team members and technical reviewers

Personnel Name:		**Andrea Leiroz**	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒

Validator/Verifier	☒	Financial Expert	☐
Technical Reviewer	☐	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope	**Technical Area**		
Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar		
	TA 1.2: Energy generation from renewable energy sources		
Waste handling and disposal	TA 13.1. Solid waste and wastewater TA 13.2. Manure		
Approved by (Manager C & T)	Sanjay Kandari		
Approval date:	17/12/2018		

Personnel Name:		**Rohit Badaya**	
Qualified to work as:			
Team Leader	☒	Technical Expert	☒
Validator/Verifier	☒	Financial Expert	☒
Technical Reviewer	☒	Local Expert (India)	☒
Area(s) of Technical Expertise			
Sectoral Scope	**Technical Area**		
Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar		
	TA 1.2: Energy generation from renewable energy sources		
Energy distribution	TA 2.1: Energy distribution		
Energy demand	TA 3.1. Energy Demand		
Waste Handling and Disposal	TA 13.1 Solid waste and wastewater TA 13.2 Manure		
Approved By	Manager Competency & Training		
Approval date:	29/12/2018		

Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider

/1/	Vital Engenharia Ambiental S.A.	CDM-PDD for Project activity "Macaúbas Landfill Gas Project" in Brazil for the first crediting period.	Version 5 of 13/12/2019	UNFCCC Website
/2/	Vital Engenharia Ambiental S.A.	CDM-PDD for Project activity "Macaúbas Landfill Gas Project" in Brazil for the second crediting period.	Version 6 of 10/04/2020 Version 8 of 18/05/2020 Version 9 of 01/06/2020 Version 10 of 04/06/2020 Version 11 of 04/09/2020	Project participant
/3/	Vital Engenharia Ambiental S.A.	Emission reduction spreadsheet for the project activity "Macaúbas Landfill Gas Project" in Brazil: 2nd CP PRC_CTR Macaubas CER v1 2020 04 10 JAS.xlsx. 2nd CP_CTR Macaubas CER v5 2020 09 04 JAS	Version 1 of 10/04/2020 Version 4 of 18/05/2020 Version 5 of 04/09/2020	Project participant
/4/	RINA	Validation opinion on changes in PDD for Project activity "Macaúbas Landfill Gas Project" in Brazil for the first crediting period.	Version 01.1Aa of 05/02/2020	UNFCCC Website
/5/	Vital Engenharia Ambiental S.A.	Waste quantities in landfill: "Quantidade de RSU - Mai-20.xls".	05/2020	Project participant
/6/	Macaúbas Meio Ambiente S/A	Waste composition in landfill: "Declaração Gravimetria.pdf".	28/04/2020	Project participant
/7/	Minas Gerais State Secretary of Environment and Sustainable Development	Landfill operation and gas capture environmental permit #145. Valid for 6 years. The renewal of the license was requested however the updated license is not yet available. a declaration nº 0035998/2019 issued by Environmental and Sustainable Development Secretary from Minas Gerais Government State on 22/01/2019, states that License of Operation nº 145 validity is postponed until the moment the operational license renewal.	30/05/2011	Project participant
/8/	Minas Gerais State Secretary of Environment and Sustainable Development	Electricity plant environmental license #88047796/2019 and valid until 14/10/2029.	14/10/2019	Project participant
/9/	Vital Engenharia Ambiental S.A.	Declaration confirming that there is no recycle center for the organic material in the landfill and that recycling of organic waste is not part of the operational procedures.	28/04/2020	Project participant
/10/	Vital Engenharia Ambiental S.A.	Project electricity consumption. Spreadsheet with consumption for each equipment: Asja Sabara_Lista Equipamentos_2020.04.27.xls.		Project participant
/11/	National Electric Agency (ANEEL)	Authorization for electricity generation to Asja Sabará Serviços para o Meio Ambiente S/A. Dispatch #963. Available at:	25/04/2018	ANEEL Website

		http://www2.aneel.gov.br/cedoc/dsp2018963ti.pdf.		
/12/	CDM Executive Board	Clean Development Mechanism Validation and Verification Standard for project activities.	Version 02.0 of 29/11/2018	UNFCCC Website
/13/	CDM Executive Board	Clean Development Mechanism Project Standard for project activities.	Version 02.0 of 29/11/2018	UNFCCC Website
/14/	CDM Executive Board	Clean Development Mechanism Project Cycle Procedure for project activities.	Version 02.0 of 29/11/2018	UNFCCC Website
/15/	CDM Executive Board	CDM-PDD-FORM: Project design document form.	Version 11.0 of 31/05/2019	UNFCCC Website
/16/	CDM Executive Board	Large-scale Consolidated Methodology ACM0001: Flaring or use of landfill gas.	Version 19.0 of 14/06/2019	UNFCCC Website
/17/	CDM Executive Board	TOOL02: Methodological tool: Combined tool to identify the baseline scenario and demonstrate additionality.	Version 07.0 of 22/09/2017	UNFCCC Website
/18/	CDM Executive Board	TOOL03: Methodological tool: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion.	Version 03.0 of 22/09/2017	UNFCCC Website
/19/	CDM Executive Board	TOOL04: Methodological tool: Emissions from solid waste disposal sites.	Version 08.0 of 04/05/2017	UNFCCC Website
/20/	CDM Executive Board	TOOL05: Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation.	Version 03.0 of 22/09/2017	UNFCCC Website
/21/	CDM Executive Board	TOOL06: Methodological tool: Project emissions from flaring.	Version 03.0 of 28/03/2019	UNFCCC Website
/22/	CDM Executive Board	TOOL07: Methodological tool: Tool to calculate the emission factor for an electricity system.	Version 07.0 of 31/08/2018	UNFCCC Website
/23/	CDM Executive Board	TOOL08: Methodological tool: Tool to determine the mass flow of a greenhouse gas in a gaseous stream.	Version 03.0 of 27/11/2015	UNFCCC Website
/24/	CDM Executive Board	TOOL09: Methodological tool: Determining the baseline efficiency of thermal or electric energy generation systems.	Version 02.0 of 27/11/2015	UNFCCC Website
/25/	CDM Executive Board	TOOL10: Methodological tool: Tool to determine the remaining lifetime of equipment.	Version 01 of 02/03/2012	UNFCCC Website
/26/	CDM Executive Board	TOOL11: Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.	Version 03.0.1	UNFCCC Website
/27/	CDM Executive Board	TOOL12: Methodological tool: Project and leakage emissions from transportation of freight.	Version 01.1.0 of 29/11/2018	UNFCCC Website
/28/	CDM Executive Board	TOOL 32: methodological tool: Positive lists of technologies.	Version 01.0 of 29/11/2018	UNFCCC Website
/29/	CDM Executive Board	Standard for application of the global warming potentials to clean development mechanism project activities and programmes of	Version 01.0, EB69, annex 3	UNFCCC Website

		activities for the second commitment period of the Kyoto protocol.		
/30/	Republic Federative of Brazil	National Policy on Solid Waste. Law #12305. Available at: http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm.	02/08/2010	Brazilian Government Website
/31/	INMET - Integrated Meteorological National Institute	Mean annual temperature and precipitation for Sabará city. Available at: http://www.bdclima.cnpm.embrapa.br.		Project participant
/32/	Environmental State Agency of São Paulo (Cetesb)	Reducing the uncertainty of methane recovered (R) in greenhouse gas inventories from waste sector and of adjustment factor (AF) in landfill gas projects under the clean development mechanism.	2010	Project participant
/33/	Intergovernmental Panel on Climate Change (IPCC)	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Available at: http://www.ipcc.ch.		IPCC Website
/34/	Interministerial Commission in Global Climate Change (DNA of Brazil)	Carbon Emission Factor for the National Grid. Available at: https://www.mctic.gov.br/mctic/opencms/ciencia/SEPED/clima/textogeral/emissao_despacho.html.		DNA Website
/35/	Biotecnogas	Efficiency of the LFG capture system. Available at: "ENC Eficiência de coleta – aterros sanitários.msg"	04/05/2012	Project participant
/36/	National Electric System Operator (ONS)	http://www.ons.org.br		Brazilian Government Website
/37/	The Mines and Energy Ministry (MME)	http://www.mme.gov.br		Brazilian Government Website
/38/	The Chamber of Electrical Energy Commercialization (CCEE)	Operator of Brazilian electric energy market. Available at: https://www.ccee.org.br/		Brazilian Government Website
/39/	Electricity Regulatory Agency (ANEEL)	http://www.aneel.gov.br		ANEEL Website
/40/	Energy Research Company	Technical transmission and distribution losses – National Energy Balance 2020 (26.3% for 2019) is the most recent data. Available at: https://www.epe.gov.br/sites-pt/publicacoes-dados-abertos/publicacoes/PublicacoesArquivos/publicacao-479/topico-521/Relato%CC%81rio%20Si%CC%81ntese%20BEN%202020-ab%202019_Final.pdf	05/2020	Energy Research Company Website
/41/	CDM Executive Board	CDM Executive Board agrees to relax mandatory site visits by DOEs for a period of three months (23	-	UNFCCC Website

		March to 23 June 2020) because of COVID-19.		
/42/	Vital Engenharia Ambiental S.A.	ERPA Agreement – 4th World Bank Auction 2020.	03/03/2020	Project participant
/43/	CDM Executive Board	Large-scale Consolidated Methodology ACM0001: Flaring or use of landfill gas.	Version 1 of 02/09/2004	UNFCCC Website

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

Table 1. CL from this validation

CL ID	01	**Section no.**	D.4	**Date:** 07/05/2020
Description of CL				
PDD – Section B.6.1: PP is requested to clarify why a value of 85% is considered under section B.6.1 of the PDD for the efficiency of the LFG capture system if it is stated under section B.6.2 that the efficiency is 65% as per feasibility study.				
Project participant response				**Date:** 14/05/2020
A footnote has been included to clarify the issue: "It is noted that ex-ante parameter "ηPJ" defines the efficiency of the LFG capture system installed in the project activity as 65%."				
Documentation provided by project participant				
DOE assessment				**Date:** 14/05/2020
KBS verified that section B.6.1 of the PDD was revised accordingly to explain that the project efficiency of 65% is considered in the calculation. Thus, this CL is closed.				

Table 2. CAR from this validation

CAR ID	01	**Section no.**	D.4	**Date:** 07/05/2020
Description of CAR				
PDD – Section B.6.3 and CERs spreadsheet: The amount of electricity consumed by the project activity was determined based on each equipment consumption. KBS verified the spreadsheet provided by PP during the audit. Nevertheless, the consumption considered in the CERs spreadsheet is different from the evidence provided.				
Project participant response				**Date:** 14/05/2020
CERs Spreadsheet amended accordingly.				
Documentation provided by project participant				
DOE assessment				**Date:** 14/05/2020
KBS verified the updated PDD and CERs spreadsheet and confirmed that the amount of electricity consumed by the project activity applied is correct. Thus, this CAR is closed.				

CAR ID	02	**Section no.**	D.4	**Date:** 07/05/2020
Description of CAR				
PDD – Section B.6.3 and CERs spreadsheet: The emission reduction spreadsheet should be updated. The CERs calculation only considered the waste disposal from 2005 to 2031. The waste disposal for the period from 2032 to 2045 was not considered in the calculation. In addition, the value considered for the year 2019 is different from the value mentioned in the evidence provided during the audit.				
Project participant response				**Date:** 14/05/2020
CERs spreadsheet and PDD amended now considering most updated evidences provided to DOE.				
Documentation provided by project participant				

DOE assessment	Date: 14/05/2020
KBS verified the updated PDD and CERs spreadsheet and confirmed that the waste disposal for the period from 2032 to 2045 is correctly applied. In addition, the value considered for the year 2019 is according to the evidence provided. The amount of waste dumped and future entrances considered in the calculation was cross-checked by KBS through the evidence provided by PP. Thus, this CAR is closed.	

CAR ID	03	Section no.	D.5	Date: 07/05/2020
Description of CAR				
PDD – Section B.6.2: As stated in the PDD, the fraction of waste type is according to the landfill internal studies. However, the values mentioned in the PDD are different from the values provided during the audit. PP is requested to revise the PDD as per evidence provided.				
Project participant response				**Date:** 14/05/2020
Amended according to the most updated evidences sent to DOE.				
Documentation provided by project participant				
DOE assessment				**Date:** 14/05/2020
KBS verified that the values mentioned in section B.6.2 of the revised PDD for the fraction of waste type is according to evidence provided. Thus, this CAR is closed.				

CAR ID	04	Section no.	Comments raised during the Request for Review Comments by UNFCCC Secretariat	Date: 27/08/2020
Description of CAR				
1) Refer to paragraph: VVS paragraph 412(a)(iv) The updated PDD (v10) concludes that case 4 (i.e. there is requirement to destroy methane, and there is existing LFG capture system) is applicable when determining the parameter FCH4,BL,y (i.e. the amount of methane that would have been destroyed in the baseline). It defines the value of FCH4,BL,R,y as zero as the requirement does not specify the amount or percentage of LFG that should be destroyed but requires the installation of a capture system, without requiring the captured LFG to be flared. It also defines the value of parameter methane destruction efficiency in the baseline (MDBL) as 1.76% to obtain parameter FCH4,hist,y, which is based on the study "Reducing the uncertainty of methane recovered (R) in GHG inventories from waste sector and of adjustment factor (AF) in landfill gas projects under CDM" which analyzed 154 Brazilian municipal solid waste landfills. The DOE is requested to explain how it validated the determination of parameter FCH4,BL,y in line with the applied methodology, in particular: (a) How the case 4 is applicable as the updated PDD (v10) on page 19 confirms that no new regulations requiring capture and combustion or use of LFG are in place and therefore the baseline scenario does not have to be updated for the second crediting period. It is observed that the project activity falls under case 3 in the first crediting period. While addressing this issue, the DOE shall also explain the nature and deliverable of applicable requirements introduced (i.e. information of the host country's regulatory requirements relating to LFG, contractual requirements, or requirements to address safety and odour concerns), and further justify the choice of zero for parameter FCH4,BL,R,y based on these applicable requirements introduced, in line with paragraph 43(b) and table 9 of the applied methodology; (b) How the determination of the value of 1.76% for MDBL to obtain parameter FCH4,hist,y from the study above is in accordance with paragraphs 47 to 49 of the applied methodology ACM0001 (v19) which require the use of historical data related to the respective project activity. It is also observed that on page 11 of the validation report, the DOE states that the MDBL value 1.76% is the value adopted for the first crediting period; however, the value applicable for the first crediting period is 20%, as shown in the registered PDD (v3) and the revised PDD (v5). It is noted that a default value (20%) shall be applied as per the paragraphs 50 – 51 of the ACM0001 (v19), if monitored/historic data of the respective project activity is not available. 2) Refer to paragraph: VVS paragraph 412(a)(iv) The updated PDD (v10) specifies the value for TDLy for ex-ante calculation as 16%, which is based on World Bank database from 2014. The DOE is requested to explain how the chosen source of data is in accordance with provisions in table 3 of the section 7.2 of Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (v3), in particular: (a) How the DOE validated that the 2014 data from World Bank is the most recent data available for Brazil. It is observed that the PDD in the first crediting period refers to National Energy Balance for the source of this parameter; (b) How the use of data year 2014 is in accordance with the requirement that in the absence of data from the relevant year, most recent figures should be used, but not older than 5 years;				

(c) How the data from World Bank reflects the annual average value within the host country, as required by the tool.

Project participant response	**Date:** 17/09/2020

1 (a)

The paragraph 39 of ACM 0001.v19 states that:

"*This section provides a procedure to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons (collectively referred to as requirement in this section).*"

The misunderstanding in the interpretation paragraph 39 mentioned above, occurred due the text "*due to regulatory or contractual requirements, to address safety and odour concerns, or for other reasons".* Project participants understood the existing LFG passive capture system and partial LFG combustion in open flares, a reason to address safety and odour concerns, considering it as mandatory requirement and due the this mistake, thus wrongly selecting case 4 on submitted PDD (v10).
As consequence, the PDD was revised and the parameter $F_{CH4,BL,y}$ was updated in line with case 3 of applied baseline methodology ACM0001 v.19 paragraph 44:

$F_{CH4,BL,y}$, = $F_{CH4,BL,sys,y}$.

1 (b)
The value of 1.76%, applied on submitted version of PDD v 10, was obtained from study "Reducing the uncertainty of methane recovered (R) in GHG inventories from waste sector and of adjustment factor (AF) in landfill gas projects under CDM", which is based on 154 Brazilian municipal solid waste landfills. This study on its "Table 1. Landfill location, operation, area (A), number of wells (W), distance between wells (Wi) and number of wells expected (We)" included several landfills, which data were considered by projects participants as an Brazilian applicable data.
One it was clarified by reviewer that use of historical data related to the respective project activity is requested, this value was removed and the revised PDD applied the value of 20 %, as per paragraph 50 of ACM0001 v.19

2 (a)

The data obtained from National Energy Balance published in 2020 (data basis 2019) was applied revised PDD corresponds to the most recent data.

2 (b)

The parameter TDL has been corrected in revised PDD, in order to provide a more updated and strictly applicable value to the reality of Brazil, in line Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (v3). Thus the data obtained from National Energy Balance 2020 (data basis 2019) was applied

2 (c)
The parameter TDL has been corrected, the applied National Energy Balance 2020 (data basis 2019) is strictly applicable to the reality of Brazil, in line Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation (v3).

Documentation provided by project participant

DOE assessment	**Date:** 17/09/2020

1) (a) The correct case is really case 3 and not case 4 since there are no policies or regulations in Brazil that require landfill gas capture or destruction other than for technical safety issues. It was a misunderstanding in the interpretation of the case since prior to the implementation of the project activity the scenario for LFG destruction is the partial release to atmosphere through the exiting LFG passive capture system and partial LFG combustion in open flares despite having no regulations that require the methane destruction. Project participant understood this non-mandatory methane destruction as a safety and odour requirement (Para 39 of ACM0001).

Considering that the revised PDD was corrected to case 3 the parameter $F_{CH4,BL,R,y}$, is no longer applicable and it was removed from PDD. Based on Para 44 of applied baseline methodology ACM0001, $F_{CH4,BL,y}$, = $F_{CH4,BL,sys,y}$.
Considering the discussion provided above by the EB revisor, it is now clear the definition of the cases. Hence, KBS and project participant understood that they made a mistake when selected the case. Thus, this report, the PDD and the emission reductions spreadsheet were revised according to case 3 and the default value of 20% for parameter $F_{CH4,BL,y}$ was applied. Also, the page 19, which had been wrongly maintained in the submitted PDD version 10, is now in accordance with revised PDD.

1) (b) Since the value applied of 1.76% is based on a study /32/ and is not specific for this landfill, PP revised the selection of the case and considered that there is no monitored or historic data on the amount of methane that was captured in the year prior to the implementation of the project activity. KBS confirmed through the study /32/ and the local expertise of the team that there is no specific information for the Macaúbas landfill but historical data for the Brazilian landfills. As a consequence, Para 50 of methodology ACM0001 was applied in order to determine the amount of methane that would have been captured and destroyed (by flaring) in the baseline due to regulatory or contractual requirements, to address safety and odour concerns. In addition, since the default value of 20% is applied, so how it results into conservative estimation of emission reductions.
Thus, this report, PDD and CERs spreadsheet were correctly updated.

2) (a) It is correct, the reference applied is not the most recent. In order to be in line with the PDD of the first crediting period, a more recent version of the national Energy balance published in 2020 was used.

2) (b) It is correct, the reference applied is not the most recent. Thus, in order to be in accordance with provisions in table 3 of the section 7.2 of Tool 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation, version 03.0, the value applied for TDL_y was correctly updated as per revised National Energy Balance 2020 (data basis 2019) prepared by the Energy Research Company.
The Energy Research Company aims to provide services to the Ministry of Mines and Energy (MME) in the area of studies and research designed to subsidize the planning of the energy sector, covering electricity, oil and natural gas and their derivatives and biofuels. The Energy Research Company is a federal public company, 100% dependent on the General Budget of the Union. The company was created by means of a provisional measure converted into law by the National Congress - Law 10.847, of March 15, 2004. And the implementation took place in a decree of August 2004.

2) (c) TDLy is estimated for the distribution and transmission networks of the Brazilian national grid which is the electricity system that the proposed CDM project activity is connected to.
Thus, this report, PDD and CERs spreadsheet were correctly updated.

Table 3. FAR from this validation

~~**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

Version	*Date*	*Description*
03.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the "CDM validation and verification standard for project activities" (CDM-EB93-A05-STAN) and version 02.0 of the "CDM project cycle procedure for project activities" (CDM-EB93-A06-PROC); • Make editorial improvements.
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: Renewal of crediting period
Keywords: crediting period, project activities, validation report