CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

CTRVV Landfill emission reduction project
Version 04
17 October 2007

A.2. Description of the project activity:

Vila Velha's landfill is owned and operated by the private company CTRVV Central de Tratamento de Resíduos Ltda. (CTRVV), who holds all necessary licences of the local and state authorities to operate the landfill as well as waste disposal contracts with the municipalities mentioned below. The landfill is located at the municipality of Vila Velha. The city has a population of approximately 320,000 inhabitants. Vila Velha is a part of the metropolitan area of Vitória, the capital of Espírito Santo State. The site receives approx. 500 tons/day of municipal and some small quantities of industrial solid waste from the surrounding municipalities Guarapari, Anchieta, Iconha, Piúma and Cachoeiro de Itapemirim. The landfill has been operated since 2002 and received until today approx. 450,000 tons of refuse. Until the closure of the landfill, expected for 2031, another 4.5 million tons of waste will be deposited.

Purpose of the Project Activity
The main objective of the project is to capture and flare landfill gas emitted from the large quantities of degrading solid municipal waste which have already been deposited at the landfill and which are to be added yet until the planned closing of the landfill site in 2031. Landfill gas contains approximately 50% of methane (CH_4), which is a powerful greenhouse gas (GHG) contributing to global warming and climate change, besides creating fire hazard on the landfill. In addition, the landfill gas causes bad odours in the vicinity of the landfill. Thus, by capturing and combusting the landfill gas, global GHG emissions are reduced significantly, local environmental impacts are mitigated and operational safety is increased.

The project activity consists of installing, operating and maintaining a comprehensive landfill gas capturing and flaring system with a capacity of 3,500 m^3/h in 2007 expanding to 5,000 m^3/h in 2031. The major benefit of the project is the reduction of approx 180,000 tons of methane emissions over the whole project life, compared to the current situation. Methane (CH_4) is a 21-times stronger greenhouse gas than CO_2, thus emissions reductions of approximately 3.34 million tons of $CO_{2\ equivalent}$ accrue in total. For the first crediting period of 7 years, the projected emission reductions are 661,183 tons of CO_2e.

Further on, following local environmental benefits arise as a result of the project implementation: reduced emissions of toxic trace gases, such as H_2S; significant reduction of bad odours; and further reduction of the fire hazard.

Contribution of the Project Activity to Sustainable Development
Beside the environmental benefits, the project will co-operate to sustainable development in Brazil.

The project is consistent with the sustainable development requirements of the Brazilian Designated National Authority, outlined at "Resolução nº 1", September 11, 2003, of the Brazilian Inter-ministerial Commission of Global Climate Change. It is the declared intention of the project company CTRVV to share parts of the revenues from the generation and sales of carbon credits with the local stakeholders, by

initiating a comprehensive social activity program linked with an innovative waste management concept, covering, among others:

- Support Environmental Education Projects for teachers from the neighbourhood areas Grande Terra Vermelha, Xurí and Camboapina;
- Promote Environmental Education as an integral part of educational programs in the neighbourhood of the landfill;
- Promote Professional Courses for the communities of Xurí and Camboapina;
- Support Trainee Programs for students of environmental disciplines in the metropolitan area of Vitória;
- Maintain main roads near the landfill, in the area of Xurí and Camboapina;
- Support the community of Camboapina, with the payment for employees who are responsible for potable water treatment;
- Support the Criadouro Conservacionista de Animais Silvestres: environmental education programs with the promotion of school visits, University research programs, species reproduction projects.

In summary, the project is likely to contribute to the sustainable development of Brazil and the local communities due to:

- Increased tax income for the municipality of Vila Velha, the state and the federal Government based on the project company's operational results.
- Improvement of the economic and social situation of local stakeholders due to the project and to the planned social activities/programs.
- Enhancement of the environmental situation in the global (reduced greenhouse gas emissions) and local (less water pollution, reduced toxic air emissions and bad odours) contexts.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	CTRVV	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

CTRVV is a private company which owns and operates the landfill. It will build, own and operate the new landfill gas collection and flaring system. CTRVV will be entitled to explore the landfill gas, eventually to generate and export electricity and to generate and transfer carbon credits accruing from the project activity.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

Brazil

A.4.1.2. Region/State/Province etc.:

Espírito Santo

A.4.1.3. City/Town/Community etc:

Vila Velha

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

CTRVV Central de Tratamento de Resíduos Ltda., Estrada do Xurí, km 11, Jabaeté, Vila Velha, Espírito Santo, Brazil.

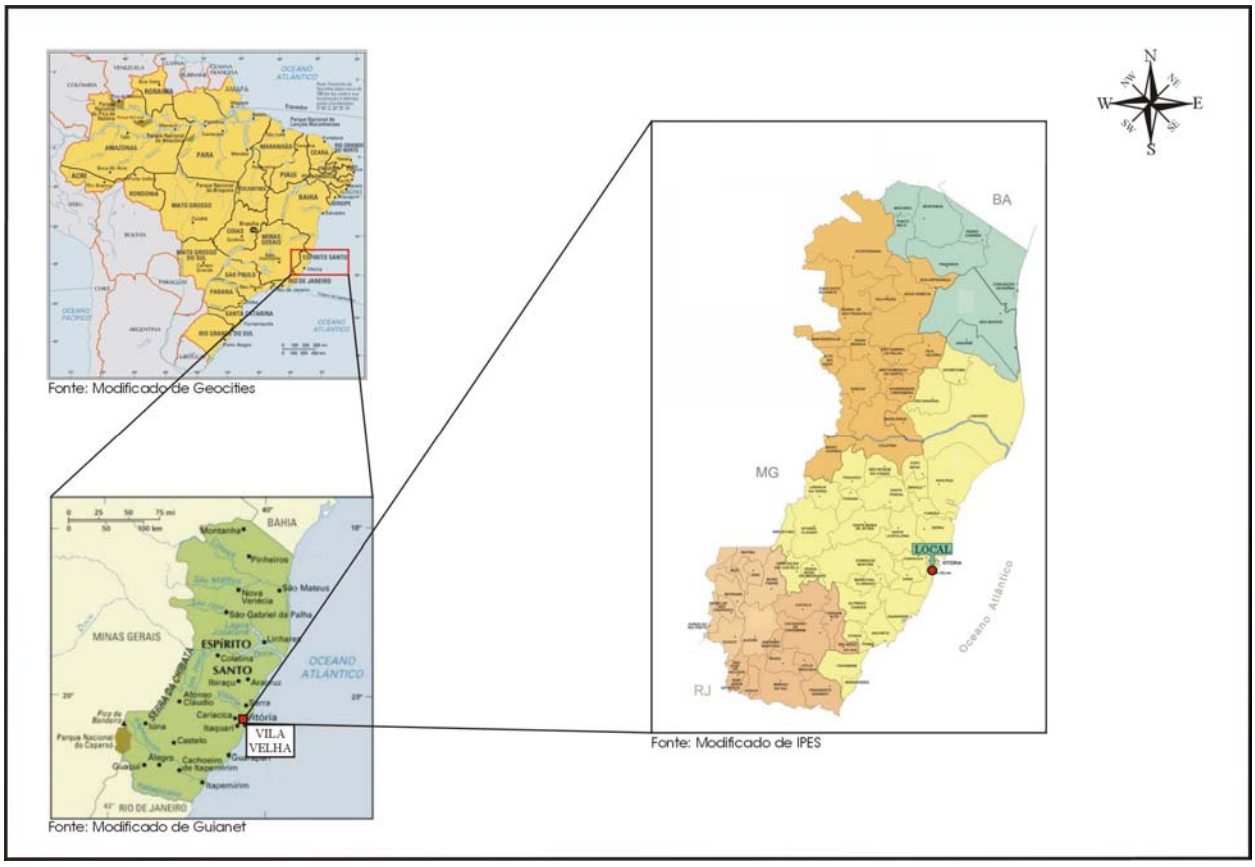

Figure 1: Location of the CTRVV landfill

A.4.2. Category(ies) of project activity:

The project activity will be a landfill gas emission reduction project under Sectoral Scope 13: waste handling and disposal.

A.4.3. Technology to be employed by the project activity:

The project activity involves investments in an active gas collection system, improvements of the leachate drainage and landfill covering system and the installation of an adequate gas flaring plant.

A gas collection system with collecting pipes, manifolds, blowers and monitoring and control systems will be installed. About 27 existing wells will be equipped with well heads connected to the gas collecting system. Another 35 to 40 new wells will be drilled and connected to the gas collection system. The new wells will be spread throughout the whole landfill. Beside the gas extraction, these wells will also serve as leachate drains. Additionally a horizontal gas collecting system will be installed in the landfill operation (disposal) area. This will allow gas collection without interfering with the landfill operation. Adequate flaring capacity (3,500 – 5,000 m^3/h) will be installed. Figure 2 below illustrates the planned gas collection and flaring system.

The aim is to collect about 3,500 m^3/h of landfill gas by begin of October 2007. The flares are to be commissioned by end of September 2007. Based on the experience and monitoring data of the first 6 months of operation, the landfill gas collecting system will be expanded by adding wells and horizontal colleting pipes. The project foresees a total of 70 to 80 gas wells resulting in collection of about 5,000 m^3/h in the year 2031.

Gas engine / generator sets (assembled to result in a power plant) can be installed to be operated by parts of the landfill gas collected. The entire electricity demand of the landfill installations can so be covered and excess energy could be sold to the grid, if an adequate power purchase agreement is obtained. In the beginning of the project, the power plant will not exist.

A further alternative use of the landfill gas is not planed at the moment, but could be considered in the future.

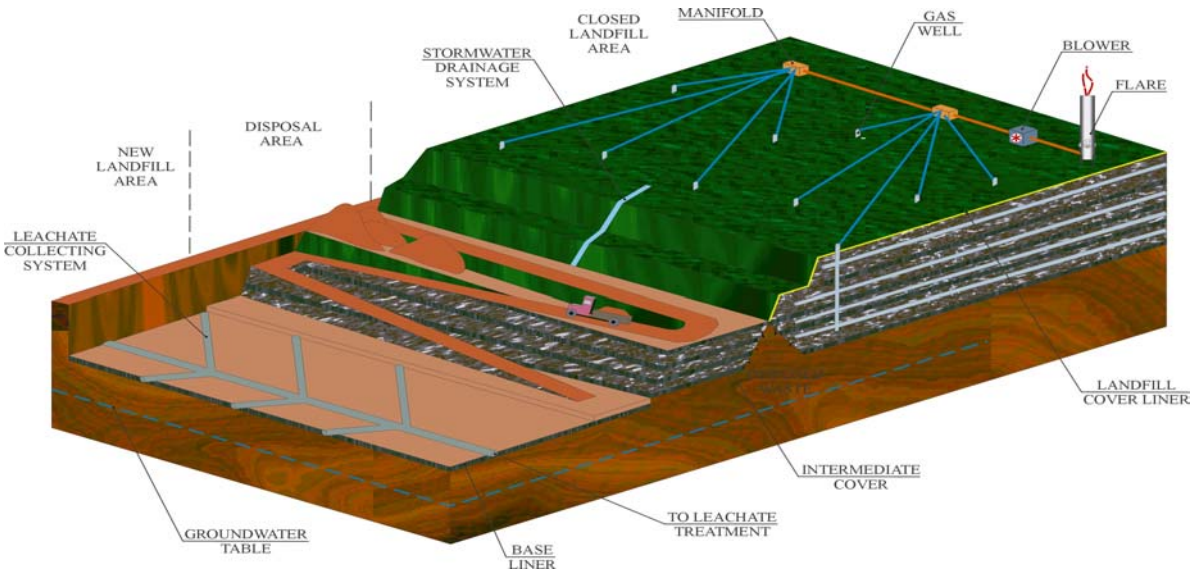

Figure 2: Sectional drawing of a landfill with gas collection / flaring system

Few components employed will have to be imported, since they are not commercially available in Brazil. With the increasing number of CDM landfill projects developed in Brazil, the knowledge of local suppliers is growing fast, which allows the installation and maintenance to be done mainly by local companies.

The following table lists the major components and the standards adhered to.

Component	Imported or locally manufactured	Standard
Wells (concrete pipes)	Locally manufactured	According to Brazil standards
Gas collection system	Partly locally manufactured and partly imported	US or EU standards (operational safety and environmental aspects)
Flaring systems	Locally manufactured	According to Brazil standards
Monitoring and control system	Partly locally manufactured and partly imported	Brazil and US/EU standards
Gas engine and generator sets	Imported from US or EU	US or EU standards (noise, emissions, operational safety)

Table 1: Major components and technologies transferred including standards adhered to

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

1st crediting period	
Year	**Annual estimation of emission reductions in tons of CO2e**
2007 (starting in 01/10/2007)	13,700
2008	67,454
2009	78,904
2010	89,264
2011	98,639
2012	107,121
2013	114,796
2014 (ending in 30/09/2014)	91,305
Total estimated reductions (tons of CO2e)	**661,183**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tons of CO2e)	**94,454**

A.4.5. Public funding of the project activity:

No public funding is involved in this project.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

Consolidated Methodology ACM0001 / Version 05 (Sectorial Scope: 13, EB 28): "Consolidated baseline methodology for landfill gas project activities".
Tool for the demonstration and assessment of additionality – Version 03 – EB29
Tool to determine project emissios from flaring gases containing methane – Annex 13 – EB 28

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology ACM0001 / Version 05 is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include gas flaring.

As a consequence, the conditions for the methodology applicability are:

- The most attractive course of action is LFG emitted directly to the atmosphere as explained in the following sections;
- No legal or contractual requirements for emission reductions;
- Baseline is occasionally burning of gas on existing gas wells;
- The proposed project activity will not claim any carbon credits from displacing or avoiding energy from other source.

B.3. Description of the sources and gases included in the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Landfill Gas Emissions	CO_2	No	Not applicable
		CH_4	Yes	Baseline condition (landfill gas released to the atmosphere)
		N_2O	No	Not applicable
Project Activity	Landfill Gas Emissions	CO_2	Yes	CO_2 emissions: quantity of electricity required multiplied with the CO_2 emissions intensity of the electricity displaced
		CH_4	Yes	Project activity condition (landfill gas released to the atmosphere and landfill gas flared)
		N_2O	No	Not applicable

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

According to the methodology ACM0001 / Version 05, the baseline scenario is the atmospheric release of the landfill gas (existing CTRVV situation).

The baseline methodology considers that some of the methane generated by the landfill may be captured and destroyed to comply with regulations or contractual requirements, or to address safety and odor concerns. In fact, currently there are 27 existing wells that occasionally flare part of the generated LFG.

In this baseline scenario no landfill gas capturing and flaring system exists. This is the activity that would take place in the absence of the proposed project activity.

Brazilian waste has a high organic content, which is greater than 60%, which results in the generation of large amounts of LFG. As there is no regulation for gas flaring, more than 90% of this gas will be released into the atmosphere.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality)

This chapter aims at the identification of the baseline scenario and demonstration of the project additionality. It is based on the document: "*Tool for the demonstration and assessment of additionality (version 3)"*, EB29, which describes the following steps:

Step 1	Identification of alternatives to the project activity consistent with mandatory laws and regulations
Step 2	Investment analysis
Step 3	Barrier analysis
Step 4	Common practice analysis

Step 1: Identification of alternatives to the project activity consistent with mandatory laws and regulations

Sub-Step 1a: Define alternatives to the project activity

The following possible and plausible baseline scenarios are considered:

1. ***No investment scenario (continuation of existing situation):*** CTRVV, the landfill owner, would continue to operate the landfill as in the past, i.e. to deposit waste until the planned closure of the landfill in 2031, without installing any landfill gas (LFG) collection and flaring equipment. In order to avoid fire hazards, a few additional venting pipes would be installed, as have been in the past. The vented gas then would be occasionally flared by manually igniting the gas. The amount of gas estimated to be flared this way would be in the same range as today, i.e. 5 to 10% of the total gas produced by the landfill.

2. ***Installation of LFG collection and flaring system, with power generation:*** CTRVV would install a comprehensive LFG collection/flaring system where the major portion of the collected LFG would subsequently be used for power generation.

3. ***Installation of LFG collection and flaring system, with energetic use in other forms than power generation:*** CTRVV would invest in a comprehensive LFG collection/flaring system, but instead of using the LFG for power generation, alternative energy forms would be produced, e.g. heat for process steam or absorption cooling applications, or fuel gas for road vehicles (e.g. for its own refuse trucks).

Step 1.b): Consistency with mandatory laws and regulations:

All plausible scenarios, including the no investment scenario (continuation of the existing situation) would be in agreement with all applicable legal requirements.

Currently, CTRVV has all necessary licenses to operate the landfill.

Step 2: Investment analysis:

Sub-Step 2a. – Determine appropriate analysis method

The CDM project activity generates no financial or economic benefits other than CDM related income. Therefore, the simple cost analysis (Option I) was selected.

Sub-Step 2b. – Option I: Apply simple cost analysis

The costs associated with the implementation of the CDM project activity is shown in Table 2.

Items	Costs (USD)
Design, Engineering Projects	70,000.00
Gas capturing system	210,000.00
Gas flaring system	900,000.00
Other costs (insurance, permitting, training, commissioning, start-up, management)	200,000.00
TOTAL	**1,380,000.00**

Table 2: Costs of the project activity

Additionally, on-going expenses will be incurred to operate the facilities and to maintain the system's components.

The destruction of methane via the project activity would not result in any income other than that derived through revenues generated from the CER exchange mechanism under the CDM. Commercializing the landfill gas would not be an alternative either. Therefore, the project activity is not financially attractive under any scenario except through registration as a CDM project.

Step 3: Barrier analysis

Sub-Step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity

The ***main barrier is of financial nature***. If the landfill operator chose to implement the project activity without its registration as a CDM project, he would have to raise the tipping fee in order to make this scenario commercially feasible. This raise would stimulate the municipalities to look for cheaper alternatives, regardless of the technique used for the waste disposal, and the CTRVV landfill would no longer be viable.

It is important to note that the majority of the municipal solid wastes generated in Brazil is disposed in open dumps and controlled landfills[1], as it is shown in Figure 3, mainly because of cost issues.

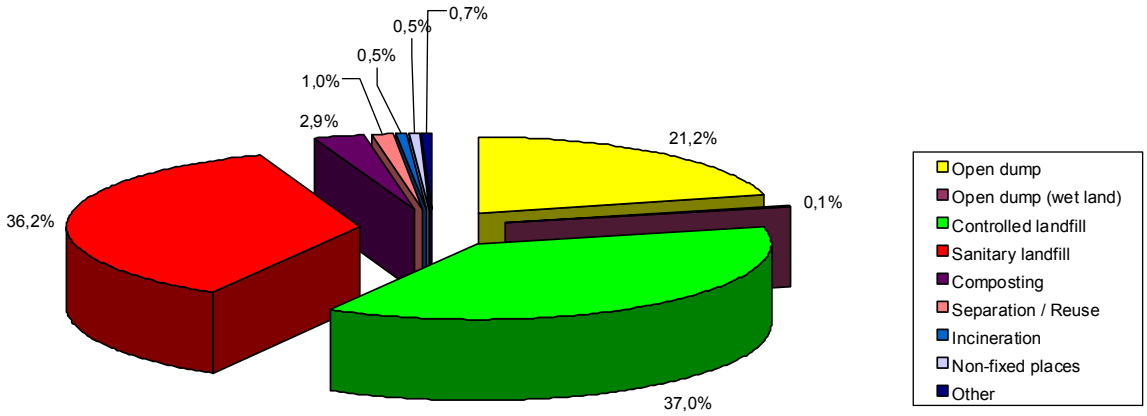

Figure 3: Waste final destination in Brazil

It is also remarkable that government subsidies are not available in Brazil for projects similar to the project activity.

[1] IBGE - Instituto Brasileiro de Geografia e Estatística. *Pesquisa Nacional de Saneamento Básico*, 2000. http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pnsb/pnsb.pdf

Sub-Step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

Table 3 shows the barriers for the alternative scenarios.

Baseline scenarios		Main Barriers
Nr. 1	No investment scenario (continuation of existing situation)	***No barriers*** apply for this scenario, since this scenario reflects the current situation. No changes of the business environment are envisaged, in particular in regard to environmental legislation. Reminder: Current legislation in Brazil does not require LFG flaring.
Nr. 3	Installation of LFG collection/flaring system, with power generation	The ***main barrier is market options.*** The electricity from LFG is not competitive with the common sources. A first governmental incentive program for alternative energy sources (PROINFA) was closed in 2004 and there is no plan for a second program. Therefore, this alternative is not feasible.
Nr. 4	Installation of LFG collection and flaring system, with energetic use in other forms than power generation	The ***main barrier is of financial nature***, since the project's IRR is expected to be even weaker than in scenario 3, mainly due to following reasons: - *Heat off-take:* No significant off-takers for heat (or cooling) energy are within reasonable distance, thus energy deliveries are economically unattractive. - *Fuel production:* "Standard LFG-to-fuel" technology is not yet commercially available and economically viable. In particular, the LFG enrichment/cleaning technology bears significant technical risks. The enriched gas would have to compete with the growing Natural Gas market.

Table 3: Barriers for the alternative scenarios

The investment barrier affects less strongly scenarios 2 and 3 than they affect the CDM project activity, because, in these scenarios, incomes other than CDM revenues are possible (e.g.: electric power generation, heat energy and fuel distribution revenues).

The investment barrier does not prevent the implementation of scenario 1. Continuation of the current situation, complying with Brazilian regulation and representing Brazilian Business as Usual is the common scenario. There is no additional investment or technology needed, in this case. Therefore, this is a viable alternative scenario.

Step 4: Common practice analysis

Sub-Step 4a: Analyze other activities similar to the proposed project activity

LFG emission is a particular situation that cannot be compared to other activities. Surface emission over the whole landfill area will occur over a long period, even after landfill closure.
In Brazil, there is no similar activity to the proposed project activity that is not under the CDM environment and the common practice in final disposal sites is not to capture and flare LFG. As shown in Figure 3, approximately 58% of the generated municipal waste is disposed in precarious or inadequate sites (dumps or controlled landfills) that do not even have gas venting systems.

Sub-Step 4b: Discuss any similar options that are occurring

There are similar projects in Brazil, which were developed and registered as CDM activities, as shown below:

- Brazil NovaGerar Landfill Gas to Energy Project – UNFCCC Ref. 0008
- Onyx Landfill Gas Recovery Project – Tremembé, Brazil – UNFCCC Ref. 0027
- Salvador da Bahia Landfill Gas Management Project – UNFCCC Ref. 0052
- Landfill Gas to Energy Project at Lara Landfill, Mauá, Brazil – UNFCCC Ref. 0091
- Brazil MARCA Landfill Gas to Energy Project – UNFCCC Ref. 0137
- ESTRE's Paulínia Landfill Gas Project (EPLGP) – UNFCCC Ref. 0165
- Caieiras landfill gas emission reduction – UNFCCC Ref. 0171

No other similar activities are observed without registration as a CDM activity.

As a consequence, it is demonstrated that the project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The calculation of the emissions reduction of the project activity follows the approach determined in the methodology (*text in italics* denotes quotes from ACM0001):

The greenhouse gas emission reduction achieved by the project activity during a given year "y" (ER_y) is estimated as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH4} + EL_y * CEF_{electricity,y} - ET_y * CEF_{thermal,y} \quad (1)$$

Where:

ER_y	*is emissions reduction, in tones of CO_2 equivalents (tCO_2e).*
$MD_{project,y}$	*the amount of methane that would have been destroyed/combusted during the year, in tones of methane (tCH_4)*
$MD_{reg,y}$	*the amount of methane that would have been destroyed/combusted during the year in the absence of the project, in tones of methane (tCH_4)*
GWP_{CH4}	*Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4*
EL_y	*Net quantity of electricity exported during year y, in megawatt hours (MWh)*
$CEF_{electricity,y}$	*CO_2 emissions intensity of the electricity displaced, in tCO_2e/MWh. This can estimated using either ACM0002 or AMSI.D, if the capacity is within the small scale threshold values, when grid electricity is used or displaced*
ET_y	*Incremental quantity of fossil fuel, defined as difference of fossil fuel used in the baseline and fossil use during project, for energy requirement on site under project activity during the year y, in TJ.*
$CEF_{thermal,y}$	*CO_2 emissions intensity of the fuel used to generate thermal/mechanical energy, in tCO_2e/TJ*

$ELy = EL_{EX,LFG} - EL_{IMP}$

Where:

$EL_{EX,LFG}$	*Net quantity of electricity exported during year y, produced using landfill gas, in megawatt hours (MWh).*
EL_{IMP}	*Net incremental electricity imported, defined as difference of project imports less any imports of electricity in the baseline, to meet the project requirements, in MWh*

In the case where the $MD_{reg,y}$ is given/defined as a quantity that quantity will be used. In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$ an "Adjustment Factor" (AF) shall be used and justified, taking into account the project context.

$$MD_{reg,y} = MD_{project,y} * AF \quad (2)$$

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} \quad (3)$$

$$MD_{flared,y} = LFG_{flare,y} * w_{CH4,y} * D_{CH4} * FE \quad (4)$$

Where $MD_{flared,y}$ is the quantity of methane destroyed by flaring, $LFG_{flare,y}$ is the quantity of landfill gas flared during the year measured in cubic meters (m_3), $w_{CH4,y}$ is the average methane fraction of the landfill gas as measured during the year and expressed as a fraction (in m^3 CH_4 / m^3 LFG), FE is the flare efficiency (the fraction of the methane destroyed) and D_{CH4} is the methane density expressed in tones of methane per cubic meter of methane (tCH_4/m^3CH_4).

Definition of AF and $MD_{reg,y}$

The Brazilian legislation does not require landfill gas to be flared. The only requirement is the venting of landfills for safety purposes, i.e. to avoid fires and explosions. This situation is highly unlikely to change over the course of the crediting period, since no regulation requiring flaring or landfill gas use is in the pipeline.

On the CTRVV landfill about half of the 27 existing wells are occasionally burning as a result of manual ignition. Due to heavy rains and intentional extinguishing of the flames when work has to be carried out near the wells, the burning is not constant. On average, it is estimated that the existing wells burn about 50-70% of the year. So it can be considered that just about 50 to 70% of the methane collected on the existing wells is burned. This estimate is conservative because it does not account for incomplete combustion of the methane, which is likely to be substantial.

As there is no suction applied on the wells the efficiency of the actual gas collection is less then 40%, compared to the final active collecting system.

Today's 27 existing wells represent about 25% of the final number of operating wells.

The collection efficiency of the existing wells is estimated to be 40% (typical values of collection efficiencies in comprehensive collection systems are above 75% [2] ; data reported in the literature show efficiencies ranging from 30 to 70% [3]; a value of 40% was used, which is consistent with the passive venting at the landfill.

Burning time is estimated to be 70% and accounts for the time intervals when the flares are not burning, due to weather (rain, wind) or landfill (LFG availability) conditions.

Based on these figures the actual amount of gas burned can be conservatively estimated as: 70% (burning time) x 40% (collection efficiency) x 25% (well number) = 7.0% of the gas estimated in the project activity. Therefore AF in the project activity is set at a rather conservative 10% for the first 7-year crediting period.

From equation (3), $MD_{project,y} = MD_{flared,y}$, as no electricity and thermal energy are considered. In fact $MD_{electricity,y}$ is greater than zero. Nevertheless, as no Emission Reduction will be claimed for electricity generation, $MD_{electricity,y}$ will be considered zero for calculation purposes.

For the Emission Reduction calculation purpose, $w_{CH4,y}$ is supposed to be 50% and FE is considered 98%.

Baseline scenario was determined by applying the ACM0001 methodology:
Brazilian waste has a high organic content (>60%), which results in generation of large amounts of LFG. According the US EPA First Order decay model (described in the software Landfill Gas Emissions Model LandGEM, version 3.02 – 2005 [4]), with L_0 = 140 m^3/ton waste and k = 0.10 $year^{-1}$, during the first crediting period, the waste produces more than 100 million m^3 CH_4. As there is no regulation for gas flaring, more then 90% is released into the atmosphere.

D_{CH4} is 0.0007168 tCH_4/m^3CH_4 at standard temperature and pressure (0 degree Celsius and 1.013 bar). D_{CH4} used in the calculations (EPA First Order decay model) is 0.0006671 tCH_4/m^3CH_4 (20 degrees Celsius and 1.013 bar).

Project scenario:
The project will be responsible for collection and flaring of at least 60% of the LFG produced.

Calculations are presented in Annex 3.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**L_0**
Data unit:	m^3 CH_4 / tonne of waste
Description:	Potential CH_4 generation capacity of waste

[2] http://dnr.wi.gov/org/aw/wm/solid/gas/finalpaperLFGefficiency2006-Michels.pdf

[3] http://www.cleantech.re.kr/note/main.cgi/200509005.pdf?down_num=1129679090&board=bbs&command=down_load&d=&filename=200509005.pdf

[4] http://www.epa.gov/ttn/catc/products.html#software

Source of data used:	EPA 430-B-96-0004, September 1996, Turning a Liability into an Asset: A Landfill Gas-to-Energy Project Development Handbook ; "Landfill Control Technologies", in: "Landfill Gas System Engineering Design Seminar", 1994
Value applied:	140
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value for the potential CH_4 generation capacity of waste (L_0) depends only on the type of waste in the landfill. The higher the organic content of the waste, the higher the value of Lo. The values of theoretical and obtainable L_0 range from 0 to 310 m^3/Mg of waste (EPA 430-B-96-0004, September 1996, Turning a Liability into an Asset: A Landfill Gas-to-Energy Project Development Handbook). According to "Landfill Control Technologies", in: "Landfill Gas System Engineering Design Seminar", 1994, L_0 ranges from 140 to 180 in wet climates. A conservative value was used.
Any comment:	These values are in line with those used in the PDD for the Nova Gerar landfill gas project, which is located in a similar climate near Rio de Janeiro, and which was registered by the CDM Executive Board in November 2004.

Data / Parameter:	**k**
Data unit:	year $^{-1}$
Description:	Rate of methane generation
Source of data used:	EPA 430-B-96-0004, September 1996, Turning a Liability into an Asset: A Landfill Gas-to-Energy Project Development Handbook ; "Landfill Control Technologies", in: "Landfill Gas System Engineering Design Seminar", 1994
Value applied:	0.10
Justification of the choice of data or description of measurement methods and procedures actually applied :	The CH_4 generation rate constant, *k*, determines the rate of CH4 generation for each submass of waste in the landfill. The higher the value of *k*, the faster the CH_4 generation rate increases and then decays over time. The value of *k* is a function of (1) waste moisture content, (2) availability of the nutrients for methanogens, (3) pH, and (4) temperature. The *k* values range from 0.003 to 0.4 (EPA 430-B-96-0004, September 1996, Turning a Liability into an Asset: A Landfill Gas-to-Energy Project Development Handbook). According to "Landfill Control Technologies", in: "Landfill Gas System Engineering Design Seminar", 1994, k ranges from 0.1 to 0.35 in wet climates. A conservative value was used.
Any comment:	These values are in line with those used in the PDD for the Nova Gerar landfill gas project, which is located in a similar climate near Rio de Janeiro, and which was registered by the CDM Executive Board in November 2004.

B.6.3 Ex-ante calculation of emission reductions:

Calculations are presented in Annex 3, using *formulae* described in section B.6.1.

B.6.4 Summary of the ex-ante estimation of emission reductions:

The summary of the ex-ante estimation of emission reductions is presented in the table below (*):

Year	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2007	9,599	23,299	0	13,700
2008	47,264	114,718	0	67,454
2009	55,287	134,191	0	78,904
2010	62,546	151,810	0	89,264
2011	69,114	167,753	0	98,639
2012	75,057	182,178	0	107,121
2013	80,435	195,231	0	114,796
2014	63,976	155,281	0	91,305
TOTAL (tonnes of CO_2e)	**463,278**	**1,124,461**	**0**	**661,183**

(*) Considering the Adjustment Factor (AF) of 10%

B.7 Application of the monitoring methodology and description of the monitoring plan:

Consolidated Methodology ACM0001 / Version 05 (Sectorial Scope: 13, EB 28): "Consolidated monitoring methodology for landfill gas project activities" was used.

The project activity can be represented in the schematic illustration shown in Figure 4:

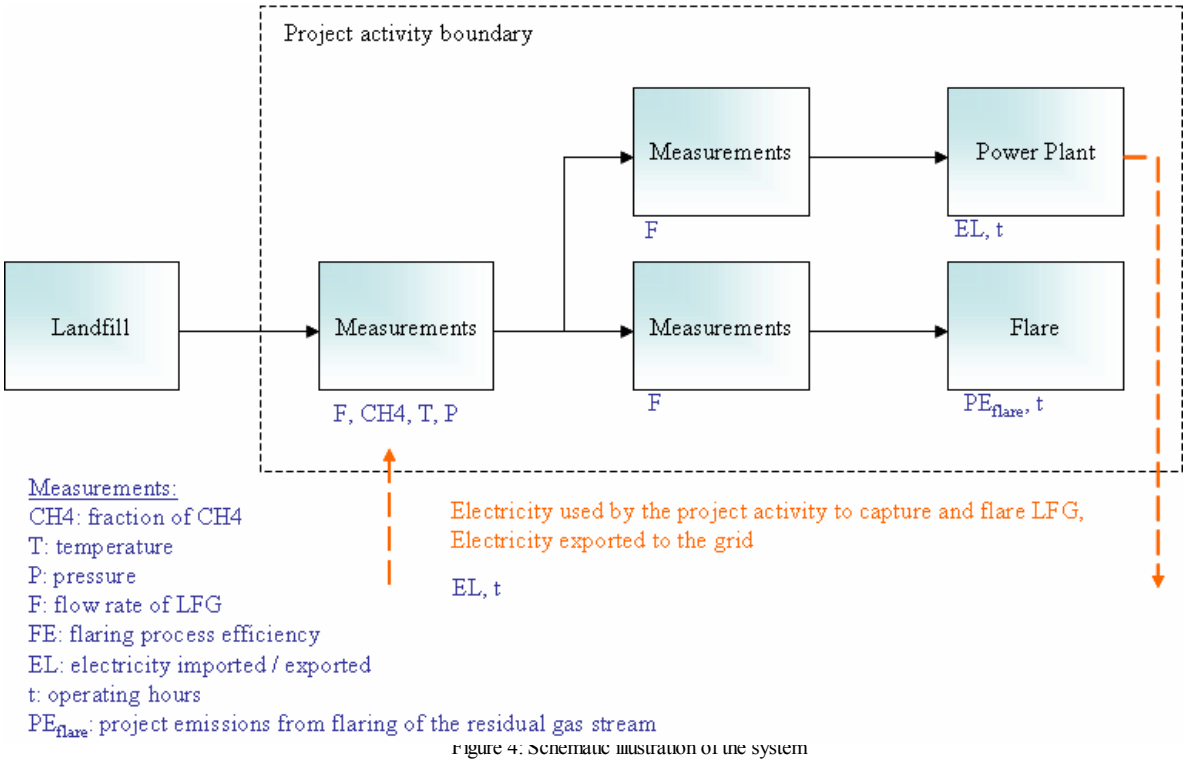

Figure 4: Schematic illustration of the system

Section B.7.1. presents all the monitored parameters of the project activity.

B.7.1 Data and parameters monitored:	
(Copy this table for each data and parameter)	
Data / Parameter:	**LFGtotal,y**
Data unit:	m^3
Description:	Total volume of landfill gas
Source of data to be used:	Measured and calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	US EPA First Order decay model – Please refer to Annex 3.
Description of measurement methods and procedures to be applied:	Measurement with a continuous flow meter. Regular recording frequency (e.g.: 1 record each 15 minutes). Data will be aggregated monthly and yearly. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Periodical calibration by an officially accredited entity, complying with the flow meter manufacturer's specifications, to ensure accuracy. Flow meter will have a regular maintenance program.
Any comment:	Automatic calculation of CH_4 density, to adjust measured values to standard temperature and pressure conditions.

Data / Parameter:	**LFGflared,y**
Data unit:	m^3
Description:	Volume of landfill gas flared
Source of data to be used:	Measured and calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	US EPA First Order decay model – Please refer to Annex 3.
Description of measurement methods and procedures to be applied:	Measurement with a continuous flow meter. Regular recording frequency (e.g.: 1 record each 15 minutes). Data will be aggregated monthly and yearly. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Periodical calibration by an officially accredited entity, complying with the flow meter manufacturer's specifications, to ensure accuracy. Flow meter will have a regular maintenance program.
Any comment:	Automatic calculation of CH_4 density, to adjust measured values to standard temperature and pressure conditions.

Data / Parameter:	**LFGelectricity,y**
Data unit:	m^3
Description:	Volume of landfill gas consumed in the power plant to generate electricity
Source of data to be used:	Measured and calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Measurement with a continuous flow meter. Regular recording frequency (e.g.: 1 record each 15 minutes). Data will be aggregated monthly and yearly. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Periodical calibration by an officially accredited entity, complying with the flow meter manufacturer's specifications, to ensure accuracy. Flow meter will have a regular maintenance program.
Any comment:	Automatic calculation of CH_4 density, to adjust measured values to standard temperature and pressure conditions.

Data / Parameter:	**$PE_{flare,y}$**
Data unit:	t CO_2e
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data to be used:	Parameters used for determining the project emissions from flaring of the residual gas stream in year y will be monitored as per the "*Tool to determine project emissions from flaring gases containing Methane*": $fv_{i,h}$, $FV_{RG,h}$, $t_{O2,h}$, $fv_{CH4,FG,h}$, T_{flare}
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Flare efficiency was considered to be 98% in the ex-ante calculations. Hence, $PE_{flare,y}$ was assumed to be 2% of the methane sent to the flare.
Description of measurement methods and procedures to be applied:	Continuous measurements and regular recording frequency (e.g.: 1 record each 15 minutes) of $fv_{i,h}$, $FV_{RG,h}$, $t_{O2,h}$, $fv_{CH4,FG,h}$, T_{flare} . Calculations according to the "*Tool to determine project emissions from flaring gases containing Methane*"
QA/QC procedures to be applied:	Please refer to $fv_{i,h}$, $FV_{RG,h}$, $t_{O2,h}$, $fv_{CH4,FG,h}$, T_{flare} below (QA/QC procedures as per the "*Tool to determine project emissions from flaring gases containing Methane*"
Any comment:	Calculations according to "*Tool to determine project emissions from flaring gases containing Methane*", using $fv_{i,h}$, $FV_{RG,h}$, $t_{O2,h}$, $fv_{CH4,FG,h}$, T_{flare}

Data / Parameter:	$w_{CH4,y}$
Data unit:	m^3 CH4 / m^3 LFG
Description:	Methane fraction in LFG
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50%
Description of measurement methods and procedures to be applied:	Measurement with a continuous analyzer. Regular recording frequency (e.g.: 1 record each 15 minutes). Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Regular maintenance and testing will ensure accuracy. Gas analyser will be calibrated periodically, according to the manufacturer's specifications.
Any comment:	-

Data / Parameter:	**LFG,T**
Data unit:	ºC
Description:	Landfill gas temperature
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	20
Description of measurement methods and procedures to be applied:	Temperature transmitter will perform continuous measurement. Regular recording frequency (e.g.: 1 record each 15 minutes). Accuracy of approximately 0.1%.
QA/QC procedures to be applied:	Temperature indicator will allow verification of the transmitted values. Regular calibration and maintenance will ensure accuracy.
Any comment:	Temperature is required to calculate methane gas density.

Data / Parameter:	**LFG,P**
Data unit:	Pa
Description:	Landfill gas pressure
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	101,325
Description of measurement methods and procedures to be applied:	Pressure transmitter will perform continuous measurement. Regular recording frequency (e.g.: 1 record each 15 minutes). Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Pressure indicator will allow verification of the transmitted values. Regular calibration and maintenance will ensure accuracy.
Any comment:	Pressure is required to calculate methane gas density.

Data / Parameter:	**EL_{IMP}**
Data unit:	MWh
Description:	Total amount of electricity imported to meet project requirement
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0 (No leakage effects need to be accounted under methodology ACM0001 Version 05 – in fact, leakage effects are negligible)
Description of measurement methods and procedures to be applied:	Energy meter will perform continuous measurement. Energy totalizer will display cumulative electricity imported. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Regular calibration and maintenance will ensure accuracy.
Any comment:	-

Data / Parameter:	$EL_{EX,LFG}$
Data unit:	MWh
Description:	Total amount of electricity exported to the grid
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Energy meter will perform continuous measurement. Energy totalizer will display cumulative electricity exported. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Regular calibration and maintenance will ensure accuracy.
Any comment:	-

Data / Parameter:	**CO_2 emission intensity of the electricity and/or other energy carriers in $EL_{EX,LFG}$**
Data unit:	tCO_2e/MWh
Description:	CO_2 emissions intensity of the electricity displaced, in tCO_2e/MWh.
Source of data to be used:	If necessary, this parameter can be estimated using either ACM0002 or AMS.1.D, if the capacity is within the small scale threshold values, when grid electricity is used or displaced.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This parameter was not used, as no Emission Reductions will be claimed for exported electricity ($EL_{EX,LFG}$) and no leakage effects need to be accounted under methodology ACM0001 Version 05 (EL_{IMP}).
Description of measurement methods and procedures to be applied:	If necessary, as specified in ACM0002 or AMS.1.D.
QA/QC procedures to be applied:	If necessary, describe all assumptions and sources used in calculations, to allow verification.
Any comment:	-

Data / Parameter:	Regulatory requirements relating to landfill gas projects
Data unit:	-
Description:	Regulatory requirements relating to landfill gas projects
Source of data to be used:	Research
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable.
Description of measurement methods and procedures to be applied:	At the renewal of crediting period, a review of regulatory criteria and permitting conditions will be performed.
QA/QC procedures to be applied:	Describe all assumptions and sources, to allow verification.
Any comment:	-

Data / Parameter:	Operation of the energy plant
Data unit:	Hours
Description:	Operating hours of the energy plant
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0
Description of measurement methods and procedures to be applied:	Run-time device will perform continuous measurement. Elapsed time totalizer will display cumulative operating hours. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Regular calibration and maintenance will ensure accuracy.
Any comment:	-

Data / Parameter:	$fv_{i,h}$
Data unit:	-
Description:	Volumetric fraction of component *i* in the residual gas in the hour *h*, where *i* = CH_4, CO, CO_2, O_2, H_2, N_2. Simplified approach: *i* = CH_4, N_2, O_2.
Source of data to be used:	Measured and calculated value. Methane and oxygen contents will be measured. Nitrogen content will be calculated (balance).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Flare efficiency was considered to be 98% in the ex-ante calculations. $fv_{i,h}$ was not used this simplified calculation. Methane content in the residual gas was considered 50%.
Description of measurement methods and procedures to be applied:	Measurement with a continuous analyzer. Regular recording frequency (e.g.: 1 record each 15 minutes). Data will be averaged hourly or at a shorter time interval. Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Regular maintenance and testing will ensure accuracy. Gas analyser will be calibrated periodically (zero check and typical value check with a standard certified gas), according to the manufacturer's specifications.
Any comment:	Simplified approach: only the methane and oxygen content of the residual gas will be measured and the remaining part will be considered N_2.

Data / Parameter:	$FV_{RG,h}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal conditions in the hour *h*
Source of data to be used:	Measured and calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	US EPA First Order decay model – Please refer to Annex 3.
Description of measurement methods and procedures to be applied:	Measurement with a continuous flow meter. Regular recording frequency (e.g.: 1 record each 15 minutes) with hourly averaged values or at a shorter time interval. Accuracy of approximately 0.5%. Same basis (dry or wet) will be used for this measurement and for the measurement of $fv_{i,h}$
QA/QC procedures to be applied:	Periodical calibration by an officially accredited entity, complying with the flow meter manufacturer's specifications, to ensure accuracy. Flow meter will have a regular maintenance program.
Any comment:	Automatic calculation to adjust measured values to standard temperature and pressure conditions.

Data / Parameter:	$t_{O2,h}$
Data unit:	-
Description:	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour *h*
Source of data to be used:	Measured and calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Flare efficiency was considered to be 98% in the ex-ante calculations. $t_{O2,h}$ was not used in this simplified calculation.
Description of measurement methods and procedures to be applied:	Measurement with a continuous analyzer. Regular recording frequency (e.g.: 1 record each 15 minutes). Accuracy of approximately 0.5%. Point of measurement will be in the upper section of the flare (above 80% of the flare height).
QA/QC procedures to be applied:	Regular maintenance and testing will ensure accuracy. Gas analyser will be calibrated periodically (zero check and typical value check with a standard certified gas), according to the manufacturer's specifications.
Any comment:	-

Data / Parameter:	$fv_{CH4,FG,h}$
Data unit:	mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h*
Source of data to be used:	Measured and calculated value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Flare efficiency was considered to be 98% in the ex-ante calculations. $fv_{CH4,FG,h}$ was not used n this simplified calculation.
Description of measurement methods and procedures to be applied:	Measurement with a continuous analyzer. Regular recording frequency (e.g.: 1 record each 15 minutes). Accuracy of approximately 0.5%. Point of measurement will be in the upper section of the flare (above 80% of the flare height).
QA/QC procedures to be applied:	Regular maintenance and testing will ensure accuracy. Gas analyser will be calibrated periodically (zero check and typical value check with a standard certified gas), according to the manufacturer's specifications.
Any comment:	Measuring instruments typically read ppmv or % values. To convert from ppmv to mg/m^3, readings will be multiplied by 0.716. 1% equals 10.000 ppmv

Data / Parameter:	T_{flare}
Data unit:	ºC
Description:	Temperature in the exaust gas of the flare
Source of data to be used:	Measured value
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Flare efficiency was considered to be 98% in the ex-ante calculations. T_{flare} was not used n this simplified calculation.
Description of measurement methods and procedures to be applied:	Measurement of the temperature of the exhaust gas stream in the flare by a type N thermocouple. Regular recording frequency (e.g.: 1 record each 15 minutes). Accuracy of approximately 0.5%.
QA/QC procedures to be applied:	Thermocouples will be replaced or calibrated every year.
Any comment:	-

Data / Parameter:	**Operation of the flare**
Data unit:	-
Description:	Flame detection
Source of data to be used:	Verified condition
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Flare efficiency was considered to be 98% in the ex-ante calculations.
Description of measurement methods and procedures to be applied:	A flame detector will continuously verify if landfill gas is actually burning in the flare. System will automatically shut down if there is no flame detection.
QA/QC procedures to be applied:	Flame detector will be inspected and calibrated every year.
Any comment:	-

B.7.2 Description of the monitoring plan:

To assure correct monitoring, the staff will be trained adequately.

A minimum of 3 operators will be trained for:

- General knowledge of the equipment used for monitoring;
- Reading and recording procedures and data storage;
- Calibration methodologies and procedures;
- Emergency situation procedures.

All monitored data (as defined under B.7.1.) will undergo an internal semi-annual review. During this review, the records will be checked by two internal persons that are not involved in the actual data recording. All data will be electronically archived and kept during the crediting period and two years after.

The two reviewers will a) double-check the quality of the data recorded and b) audit the GHG project compliance with operational requirements. If they identify a need for corrective actions they propose the same to the management of CTRVV. The reviewers will summarize their findings in written form. The semi-annual review will be scheduled in a way that one of the reviews is always carried out within 30 days before the data is submitted for independent validation.

Sustainable development indicators will also be monitored. The amount of money spent in each sustainable development project will be accounted. The following additional indicators will be monitored:

- Support Environmental Education Projects for teachers from the neighbourhood areas Grande Terra Vermelha, Xurí and Camboapina: number of teachers trained
- Promote Environmental Education as an integral part of educational programs in the neighbourhood of the landfill: number of students taught;
- Promote Professional Courses for the communities of Xurí and Camboapina: number of professional courses supported and number of students taught;
- Support Trainee Programs for students of environmental disciplines in the metropolitan area of Vitória: numer of trainees accepted;
- Maintain main roads near the landfill, in the area of Xurí and Camboapina: extension of roads maintained;
- Support the community of Camboapina, with the payment for employees who are responsible for potable water treatment: payments made;
- Support the Criadouro Conservacionista de Animais Silvestres: environmental education programs with the promotion of school visits, University research programs, species reproduction projects: number of school visits, research programs and produced species.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The application of the baseline study and monitoring methodology was completed in 29/08/2006 and revised in 12/02/2007.

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SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

05/03/2007

C.1.2. Expected operational lifetime of the project activity:

21 years.

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/10/2007

C.2.1.2. Length of the first crediting period:

7 years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable.

C.2.2.2. Length:

Not applicable.

SECTION D. Environmental impacts

By collecting and combusting landfill gas, the CTRVV LFG project will reduce both global and local environmental effects of uncontrolled releases. The major components of landfill gas, methane and carbon dioxide, are colourless and odourless. The main global environmental concern over these compounds is the fact that they are greenhouse gases. Although the majority of landfill gas emissions are quickly diluted in the atmosphere, in confined spaces there is a risk of asphyxiation and/or toxic effects if landfill gas is present at high concentrations. Landfill gas also contains over 150 trace components that can cause other local and global environmental effects such as odour nuisances, stratospheric ozone layer depletion, and ground level ozone creation. Through an appropriate management, the CTRVV landfill gas will be captured and combusted, removing the risks of toxic effects on the local community and local environment.

The project is likely to result in a reduction of toxic trace gases such as H_2S. On the other hand, formation of new toxic trace compounds, and notably dioxins, as a result of the project is likely to be completely negligible due to the fact that the CTRVV landfill receives almost no industrial (but rather municipal) waste.

Where methane is burned to obtain Carbon Credits, operational practices at the landfill are improved thus contributing to sustainable development. Specifically for landfills, sustainable means accelerating waste stabilisation such that the landfill processes can be said to be largely complete within one generation (30 - 50 years). This ensures that both leachate and methane are more carefully managed and controlled, and the degradation processes are accelerated.

Groundwater and surface water can be contaminated by untreated leachate from landfill sites. Leachate may cause serious water pollution if not properly managed. Surface water run-off from a landfill site can also cause unacceptable sediment loads in receiving waters, while uncontrolled surface water run-on can lead to excessive generation of leachate and migration of contaminated waters off-site. With CTRVV improving appropriate management on the site, these problems will be reduced.

Other potential hazards and amenity impacts include the risks of fire or explosions, landfill gas migration, dust, odour, pests, vermin, unsightliness and litter, each of which may occur onsite or off-site. They are all minimised by an appropriate management of the CTRVV landfill.

In addition, the following aspects of the landfill gas project have also been addressed:

- Noise - There will be some increase in noise from the site associated with energy recovery, although the engines will be housed to reduce noise emissions. The impacts are likely to be marginal given the noise typically associated with operations at the landfill.
- Visual amenity - Placement of energy recovery facilities at the landfill site will increase the visual presence of the site, however the impacts are expected to be marginal given the visual intrusion currently associated with the waste disposal operations.

The landfill gas project of CTRVV promotes in parallel best practices to improve landfill management standards, and contributes towards a global sustainable development.

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

To obtain the environmental license, new landfills or site expansions need an Environmental Impact Assessment (EIA-RIMA by Brazilian law). The EIA was conducted in 1999 by Adalberto Leão Bretas, civil and sanitary engineer, for an area of 6 ha. CTRVV owns the operation environmental license LO SL/N^{o} 032/2005/Classe IV, issued in 09 March 2005.

For the implementation of the landfill gas collecting system an engineering conceptual project was prepared to obtain the installing and operating license. The permitting process was submitted to the environmental agency in 06 December 2006 and the corresponding installation license LI – GCA/SAIA/N^{o} 047/2007/CLASSE II was issued in 06 March 2007.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

No significant negative impacts to the environment will result from the project activity. On the contrary, the following environmental benefits will result in:
• Significant reduction of methane emission
• Generation of green energy
• Reduction of toxic gas emission (H_2S, organic mercury compounds)
• Improvement of landfill cover, reducing leachate generation
• Leachate pumping, reducing risk of groundwater pollution
• Reduction of nuisance odour

SECTION E. Stakeholders' comments

The project company acknowledges the importance of sound corporate governance and a transparent information policy, and thus pays great attention to healthy relations with all stakeholders involved. To foster the project's acceptance, the various local stakeholders will be informed on all details of the project on different occasions. Stakeholders will be invited to submit their comments or ideas regarding the project and its design at any time. Any comments and the results of discussions will be reported, summarised and published, and will be considered by the project company during the further development of the project (see details below).

E.1. Brief description how comments by local stakeholders have been invited and compiled:

Based on the resolution N.1.[5] of the Brazilian Designate National Authority represented by the Interministerial Commission on Climate Change (Comissão Interministerial de Mudança Global do Clima), the following entities are to be addressed in the course of the stakeholder process:

• Municipal governments and City Councils;
• State and Municipal Environmental Agencies;
• Brazilian Forum of NGOs and Social Movements for Environment and Development;
• Community associations;
• Ministério Público (State Attorney for the Public Interest).

[5] http://www.mct.gov.br/upd_blob/2736.pdf

In line with this resolution, the following stakeholders will be addressed in the period of September and October 2006:

- Prefeitura Municipal de Vila Velha
- Secretaria Municipal de Meio-Ambiente de Vila Velha (SEMMA)
- Câmara dos Vereadores de Vila Velha
- Secretaria de Estado do Meio Ambiente e Recursos Hídricos (SEAMA)
- Associação de Moradores de Bairros (Xurí, Camboapina)
- Ministério Público do Estado do Espírito Santo
- Fórum Brasileiro de ONGs

E.2. Summary of the comments received:

During the public consultation period, only the Brazilian Forum of NGOs (FBOMS) provided one comment, suggesting that CTRVV adopted additional criteria for the social activity programs, such as those described in the Gold Standard [6].

E.3. Report on how due account was taken of any comments received:

CTRVV responded to the Brazilian Forum of NGOs (FBOMS), mentioning that the use of the Gold Standard will be evaluated. CTRVV also stated that transparency, one of Gold Standard's main principles, is absolutely necessary for the project and that all related social activities will be frequently disclosed to the public.

[6] http://www.cdmgoldstandard.org/

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	CTRVV Central de Tratamento de Resíduos Ltda.
Street/P.O.Box:	Rua Enrique Laranja 264, Cobertura
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

NO PUBLIC FUNDING INVOLVED

Annex 3

BASELINE INFORMATION

USER INPUTS **Landfill Name or Identifier:** CTR VILA VELHA

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	2002	
Landfill Closure Year	2031	
Have Model Calculate Closure Year?	○ Yes ◉ No	
Waste Design Capacity		*megagrams*

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year*$^{-1}$)
User-specified

User-specified k value should be based on site-specific data and determined by EPA Method 2E.
User-specified value: 0,100

Potential Methane Generation Capacity, L_o (*m*^{3}/*Mg*)
User-specified

User-specified Lo value should be based on site-specific data and determined by waste type and composition.
User-specified value: 140

NMOC Concentration (*ppmv as hexane*)
CAA - 4,000

Methane Content (*% by volume*)
CAA - 50% by volume

3: SELECT GASES/POLLUTANTS

Default pollutant parameters are currently being used by model.

Gas / Pollutant #1
Total landfill gas

Gas / Pollutant #2
Methane

Gas / Pollutant #3
Carbon dioxide

Gas / Pollutant #4
NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
2002	12.750	14.025
2003	128.522	141.374
2004	128.729	141.602
2005	180.000	198.000
2006	180.000	198.000
2007	180.000	198.000
2008	180.000	198.000
2009	180.000	198.000
2010	180.000	198.000
2011	180.000	198.000
2012	180.000	198.000
2013	180.000	198.000
2014	180.000	198.000
2015	180.000	198.000
2016	180.000	198.000
2017	180.000	198.000
2018	180.000	198.000
2019	180.000	198.000
2020	180.000	198.000
2021	180.000	198.000
2022	180.000	198.000
2023	180.000	198.000
2024	180.000	198.000
2025	180.000	198.000
2026	180.000	198.000
2027	180.000	198.000
2028	180.000	198.000
2029	180.000	198.000
2030	180.000	198.000
2031	180.000	198.000
2032		
2033		
2034		
2035		
2036		
2037		
2038		
2039		
2040		
2041		

METHANE

Landfill Name or Identifier: CTR VILA VELHA

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10}\right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)

i = 1-year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1-year time increment

k = methane generation rate ($year^{-1}$)

L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the i^{th} year (Mg)

t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

Model Parameters from User Inputs:

k = 0,100 $year^{-1}$

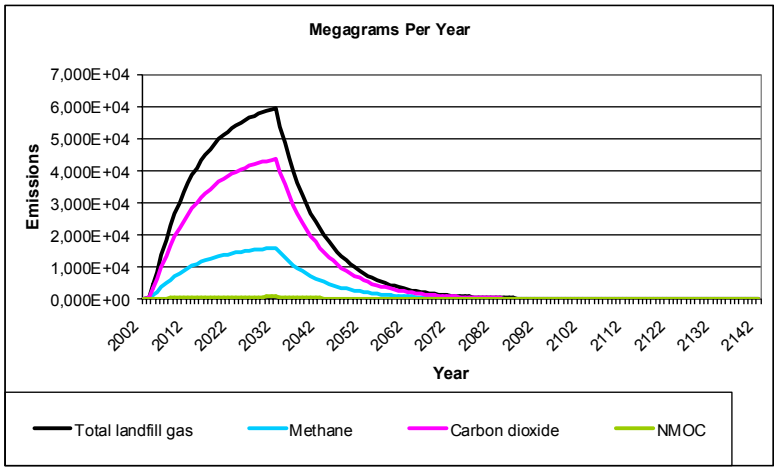
L_o = 140 m^3/Mg

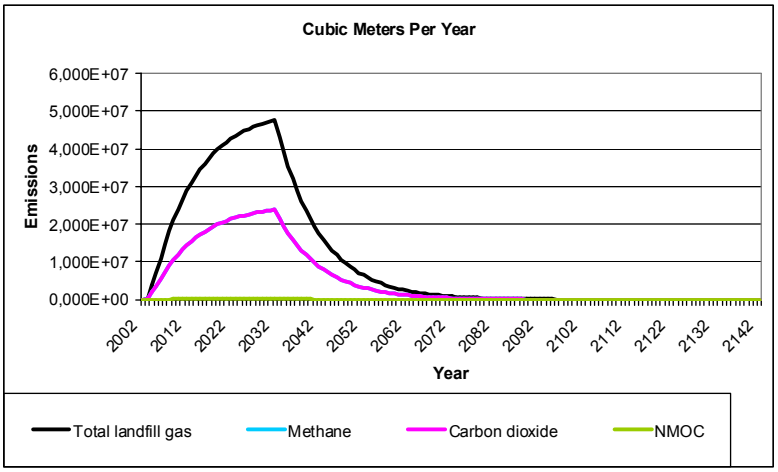
When Model Calculates Closure Year…

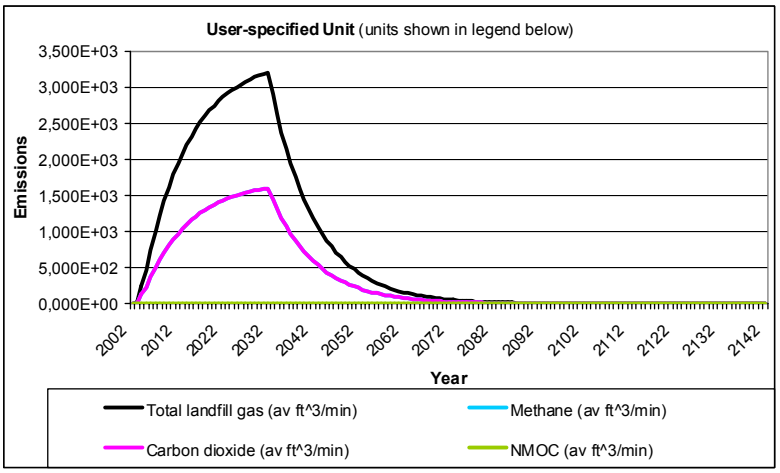
Final Non-Zero Acceptance Entered =	180.000	*megagrams* in	2031
Waste Design Capacity =		*megagrams*	
Closure Year (with 80-year limit) =	2031		
Actual Closure Year (without limit) =	2031		
Model Waste Acceptance Limit =	80	*years*	

Year	User Waste Acceptance Inputs *(Mg/year)*	User Waste-In Place *(Mg)*	Waste Acceptance *(Mg/year)*	Waste-In-Place *(Mg)*
2002	12.750	0	12.750	0
2003	128.522	12.750	128.522	12.750
2004	128.729	141.272	128.729	141.272
2005	180.000	270.001	180.000	270.001
2006	180.000	450.001	180.000	450.001
2007	180.000	630.001	180.000	630.001
2008	180.000	810.001	180.000	810.001
2009	180.000	990.001	180.000	990.001
2010	180.000	1.170.001	180.000	1.170.001
2011	180.000	1.350.001	180.000	1.350.001
2012	180.000	1.530.001	180.000	1.530.001
2013	180.000	1.710.001	180.000	1.710.001
2014	180.000	1.890.001	180.000	1.890.001
2015	180.000	2.070.001	180.000	2.070.001
2016	180.000	2.250.001	180.000	2.250.001
2017	180.000	2.430.001	180.000	2.430.001
2018	180.000	2.610.001	180.000	2.610.001
2019	180.000	2.790.001	180.000	2.790.001
2020	180.000	2.970.001	180.000	2.970.001
2021	180.000	3.150.001	180.000	3.150.001
2022	180.000	3.330.001	180.000	3.330.001
2023	180.000	3.510.001	180.000	3.510.001
2024	180.000	3.690.001	180.000	3.690.001
2025	180.000	3.870.001	180.000	3.870.001
2026	180.000	4.050.001	180.000	4.050.001
2027	180.000	4.230.001	180.000	4.230.001
2028	180.000	4.410.001	180.000	4.410.001
2029	180.000	4.590.001	180.000	4.590.001
2030	180.000	4.770.001	180.000	4.770.001
2031	180.000	4.950.001	180.000	4.950.001
2032	0	5.130.001	0	5.130.001
2033	0	5.130.001	0	5.130.001
2034	0	5.130.001	0	5.130.001
2035	0	5.130.001	0	5.130.001
2036	0	5.130.001	0	5.130.001
2037	0	5.130.001	0	5.130.001
2038	0	5.130.001	0	5.130.001
2039	0	5.130.001	0	5.130.001
2040	0	5.130.001	0	5.130.001
2041	0	5.130.001	0	5.130.001
2042	0	5.130.001	0	5.130.001
2043	0	5.130.001	0	5.130.001
2044	0	5.130.001	0	5.130.001
2045	0	5.130.001	0	5.130.001
2046	0	5.130.001	0	5.130.001
2047	0	5.130.001	0	5.130.001
2048	0	5.130.001	0	5.130.001
2049	0	5.130.001	0	5.130.001
2050	0	5.130.001	0	5.130.001
2051	0	5.130.001	0	5.130.001
2052	0	5.130.001	0	5.130.001
2053	0	5.130.001	0	5.130.001
2054	0	5.130.001	0	5.130.001
2055	0	5.130.001	0	5.130.001
2056	0	5.130.001	0	5.130.001
2057	0	5.130.001	0	5.130.001
2058	0	5.130.001	0	5.130.001
2059	0	5.130.001	0	5.130.001
2060	0	5.130.001	0	5.130.001
2061	0	5.130.001	0	5.130.001

GRAPHS **Landfill Name or Identifier:** CTR VILA VELHA







RESULTS **Landfill Name or Identifier:** CTR VILA VELHA

Closure Year (with 80-year limit) = 2031

Methane = 50 *% by volume*

Please choose a third unit of measure to represent all of the emission rates below.

User-specified Unit: *av ft^3/min*

Year	Waste Accepted		Waste-In-Place		Total landfill gas			Methane			Carbon dioxide			NMOC		
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2002	12.750	14.025	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	128.522	141.374	12.750	14.025	4,264E+02	3,414E+05	2,294E+01	1,139E+02	1,707E+05	1,147E+01	3,125E+02	1,707E+05	1,147E+01	4,895E+00	1,366E+03	9,176E-02
2004	128.729	141.602	141.272	155.399	4,684E+03	3,751E+06	2,520E+02	1,251E+03	1,875E+06	1,260E+02	3,433E+03	1,875E+06	1,260E+02	5,378E+01	1,500E+04	1,008E+00
2005	180.000	198.000	270.001	297.001	8,543E+03	6,841E+06	4,596E+02	2,282E+03	3,420E+06	2,298E+02	6,261E+03	3,420E+06	2,298E+02	9,808E+01	2,736E+04	1,839E+00
2006	180.000	198.000	450.001	495.001	1,375E+04	1,101E+07	7,398E+02	3,673E+03	5,505E+06	3,699E+02	1,008E+04	5,505E+06	3,699E+02	1,579E+02	4,404E+04	2,959E+00
2007	180.000	198.000	630.001	693.001	1,846E+04	1,478E+07	9,932E+02	4,931E+03	7,391E+06	4,966E+02	1,353E+04	7,391E+06	4,966E+02	2,120E+02	5,913E+04	3,973E+00
2008	180.000	198.000	810.001	891.001	2,272E+04	1,820E+07	1,223E+03	6,070E+03	9,098E+06	6,113E+02	1,665E+04	9,098E+06	6,113E+02	2,609E+02	7,278E+04	4,890E+00
2009	180.000	198.000	990.001	1.089.001	2,658E+04	2,128E+07	1,430E+03	7,100E+03	1,064E+07	7,151E+02	1,948E+04	1,064E+07	7,151E+02	3,052E+02	8,514E+04	5,720E+00
2010	180.000	198.000	1.170.001	1.287.001	3,007E+04	2,408E+07	1,618E+03	8,032E+03	1,204E+07	8,089E+02	2,204E+04	1,204E+07	8,089E+02	3,452E+02	9,632E+04	6,472E+00
2011	180.000	198.000	1.350.001	1.485.001	3,323E+04	2,661E+07	1,788E+03	8,876E+03	1,330E+07	8,939E+02	2,435E+04	1,330E+07	8,939E+02	3,815E+02	1,064E+05	7,151E+00
2012	180.000	198.000	1.530.001	1.683.001	3,609E+04	2,890E+07	1,942E+03	9,639E+03	1,445E+07	9,708E+02	2,645E+04	1,445E+07	9,708E+02	4,143E+02	1,156E+05	7,766E+00
2013	180.000	198.000	1.710.001	1.881.001	3,867E+04	3,097E+07	2,081E+03	1,033E+04	1,548E+07	1,040E+03	2,834E+04	1,548E+07	1,040E+03	4,440E+02	1,239E+05	8,323E+00
2014	180.000	198.000	1.890.001	2.079.001	4,101E+04	3,284E+07	2,207E+03	1,095E+04	1,642E+07	1,103E+03	3,006E+04	1,642E+07	1,103E+03	4,709E+02	1,314E+05	8,826E+00
2015	180.000	198.000	2.070.001	2.277.001	4,313E+04	3,454E+07	2,320E+03	1,152E+04	1,727E+07	1,160E+03	3,161E+04	1,727E+07	1,160E+03	4,952E+02	1,381E+05	9,282E+00
2016	180.000	198.000	2.250.001	2.475.001	4,504E+04	3,607E+07	2,423E+03	1,203E+04	1,803E+07	1,212E+03	3,301E+04	1,803E+07	1,212E+03	5,172E+02	1,443E+05	9,694E+00
2017	180.000	198.000	2.430.001	2.673.001	4,678E+04	3,746E+07	2,517E+03	1,249E+04	1,873E+07	1,258E+03	3,428E+04	1,873E+07	1,258E+03	5,370E+02	1,498E+05	1,007E+01
2018	180.000	198.000	2.610.001	2.871.001	4,834E+04	3,871E+07	2,601E+03	1,291E+04	1,936E+07	1,301E+03	3,543E+04	1,936E+07	1,301E+03	5,551E+02	1,548E+05	1,040E+01
2019	180.000	198.000	2.790.001	3.069.001	4,976E+04	3,985E+07	2,677E+03	1,329E+04	1,992E+07	1,339E+03	3,647E+04	1,992E+07	1,339E+03	5,713E+02	1,594E+05	1,071E+01
2020	180.000	198.000	2.970.001	3.267.001	5,105E+04	4,088E+07	2,747E+03	1,364E+04	2,044E+07	1,373E+03	3,741E+04	2,044E+07	1,373E+03	5,861E+02	1,635E+05	1,099E+01
2021	180.000	198.000	3.150.001	3.465.001	5,221E+04	4,181E+07	2,809E+03	1,395E+04	2,090E+07	1,405E+03	3,826E+04	2,090E+07	1,405E+03	5,994E+02	1,672E+05	1,124E+01
2022	180.000	198.000	3.330.001	3.663.001	5,326E+04	4,265E+07	2,866E+03	1,423E+04	2,132E+07	1,433E+03	3,903E+04	2,132E+07	1,433E+03	6,115E+02	1,706E+05	1,146E+01
2023	180.000	198.000	3.510.001	3.861.001	5,421E+04	4,341E+07	2,917E+03	1,448E+04	2,171E+07	1,458E+03	3,973E+04	2,171E+07	1,458E+03	6,224E+02	1,736E+05	1,167E+01
2024	180.000	198.000	3.690.001	4.059.001	5,507E+04	4,410E+07	2,963E+03	1,471E+04	2,205E+07	1,482E+03	4,036E+04	2,205E+07	1,482E+03	6,323E+02	1,764E+05	1,185E+01
2025	180.000	198.000	3.870.001	4.257.001	5,585E+04	4,472E+07	3,005E+03	1,492E+04	2,236E+07	1,502E+03	4,093E+04	2,236E+07	1,502E+03	6,412E+02	1,789E+05	1,202E+01
2026	180.000	198.000	4.050.001	4.455.001	5,656E+04	4,529E+07	3,043E+03	1,511E+04	2,264E+07	1,521E+03	4,145E+04	2,264E+07	1,521E+03	6,493E+02	1,811E+05	1,217E+01
2027	180.000	198.000	4.230.001	4.653.001	5,719E+04	4,580E+07	3,077E+03	1,528E+04	2,290E+07	1,539E+03	4,192E+04	2,290E+07	1,539E+03	6,566E+02	1,832E+05	1,231E+01
2028	180.000	198.000	4.410.001	4.851.001	5,777E+04	4,626E+07	3,108E+03	1,543E+04	2,313E+07	1,554E+03	4,234E+04	2,313E+07	1,554E+03	6,633E+02	1,850E+05	1,243E+01
2029	180.000	198.000	4.590.001	5.049.001	5,829E+04	4,668E+07	3,136E+03	1,557E+04	2,334E+07	1,568E+03	4,272E+04	2,334E+07	1,568E+03	6,693E+02	1,867E+05	1,255E+01
2030	180.000	198.000	4.770.001	5.247.001	5,876E+04	4,706E+07	3,162E+03	1,570E+04	2,353E+07	1,581E+03	4,307E+04	2,353E+07	1,581E+03	6,747E+02	1,882E+05	1,265E+01
2031	180.000	198.000	4.950.001	5.445.001	5,919E+04	4,740E+07	3,185E+03	1,581E+04	2,370E+07	1,592E+03	4,338E+04	2,370E+07	1,592E+03	6,796E+02	1,896E+05	1,274E+01
2032	0	0	5.130.001	5.643.001	5,958E+04	4,771E+07	3,205E+03	1,591E+04	2,385E+07	1,603E+03	4,366E+04	2,385E+07	1,603E+03	6,840E+02	1,908E+05	1,282E+01
2033	0	0	5.130.001	5.643.001	5,391E+04	4,317E+07	2,900E+03	1,440E+04	2,158E+07	1,450E+03	3,951E+04	2,158E+07	1,450E+03	6,189E+02	1,727E+05	1,160E+01
2034	0	0	5.130.001	5.643.001	4,878E+04	3,906E+07	2,624E+03	1,303E+04	1,953E+07	1,312E+03	3,575E+04	1,953E+07	1,312E+03	5,600E+02	1,562E+05	1,050E+01
2035	0	0	5.130.001	5.643.001	4,414E+04	3,534E+07	2,375E+03	1,179E+04	1,767E+07	1,187E+03	3,235E+04	1,767E+07	1,187E+03	5,067E+02	1,414E+05	9,499E+00
2036	0	0	5.130.001	5.643.001	3,994E+04	3,198E+07	2,149E+03	1,067E+04	1,599E+07	1,074E+03	2,927E+04	1,599E+07	1,074E+03	4,585E+02	1,279E+05	8,595E+00
2037	0	0	5.130.001	5.643.001	3,614E+04	2,894E+07	1,944E+03	9,652E+03	1,447E+07	9,721E+02	2,648E+04	1,447E+07	9,721E+02	4,149E+02	1,157E+05	7,777E+00
2038	0	0	5.130.001	5.643.001	3,270E+04	2,618E+07	1,759E+03	8,734E+03	1,309E+07	8,796E+02	2,396E+04	1,309E+07	8,796E+02	3,754E+02	1,047E+05	7,037E+00
2039	0	0	5.130.001	5.643.001	2,959E+04	2,369E+07	1,592E+03	7,903E+03	1,185E+07	7,959E+02	2,168E+04	1,185E+07	7,959E+02	3,397E+02	9,476E+04	6,367E+00
2040	0	0	5.130.001	5.643.001	2,677E+04	2,144E+07	1,440E+03	7,151E+03	1,072E+07	7,202E+02	1,962E+04	1,072E+07	7,202E+02	3,074E+02	8,575E+04	5,761E+00
2041	0	0	5.130.001	5.643.001	2,422E+04	1,940E+07	1,303E+03	6,470E+03	9,698E+06	6,516E+02	1,775E+04	9,698E+06	6,516E+02	2,781E+02	7,759E+04	5,213E+00
2042	0	0	5.130.001	5.643.001	2,192E+04	1,755E+07	1,179E+03	5,854E+03	8,775E+06	5,896E+02	1,606E+04	8,775E+06	5,896E+02	2,516E+02	7,020E+04	4,717E+00
2043	0	0	5.130.001	5.643.001	1,983E+04	1,588E+07	1,067E+03	5,297E+03	7,940E+06	5,335E+02	1,453E+04	7,940E+06	5,335E+02	2,277E+02	6,352E+04	4,268E+00
2044	0	0	5.130.001	5.643.001	1,794E+04	1,437E+07	9,655E+02	4,793E+03	7,185E+06	4,827E+02	1,315E+04	7,185E+06	4,827E+02	2,060E+02	5,748E+04	3,862E+00
2045	0	0	5.130.001	5.643.001	1,624E+04	1,300E+07	8,736E+02	4,337E+03	6,501E+06	4,368E+02	1,190E+04	6,501E+06	4,368E+02	1,864E+02	5,201E+04	3,494E+00
2046	0	0	5.130.001	5.643.001	1,469E+04	1,176E+07	7,905E+02	3,924E+03	5,882E+06	3,952E+02	1,077E+04	5,882E+06	3,952E+02	1,687E+02	4,706E+04	3,162E+00
2047	0	0	5.130.001	5.643.001	1,329E+04	1,065E+07	7,152E+02	3,551E+03	5,323E+06	3,576E+02	9,743E+03	5,323E+06	3,576E+02	1,526E+02	4,258E+04	2,861E+00
2048	0	0	5.130.001	5.643.001	1,203E+04	9,632E+06	6,472E+02	3,213E+03	4,816E+06	3,236E+02	8,816E+03	4,816E+06	3,236E+02	1,381E+02	3,853E+04	2,589E+00
2049	0	0	5.130.001	5.643.001	1,088E+04	8,715E+06	5,856E+02	2,907E+03	4,358E+06	2,928E+02	7,977E+03	4,358E+06	2,928E+02	1,250E+02	3,486E+04	2,342E+00
2050	0	0	5.130.001	5.643.001	9,848E+03	7,886E+06	5,299E+02	2,631E+03	3,943E+06	2,649E+02	7,218E+03	3,943E+06	2,649E+02	1,131E+02	3,154E+04	2,119E+00
2051	0	0	5.130.001	5.643.001	8,911E+03	7,136E+06	4,794E+02	2,380E+03	3,568E+06	2,397E+02	6,531E+03	3,568E+06	2,397E+02	1,023E+02	2,854E+04	1,918E+00
2052	0	0	5.130.001	5.643.001	8,063E+03	6,457E+06	4,338E+02	2,154E+03	3,228E+06	2,169E+02	5,909E+03	3,228E+06	2,169E+02	9,257E+01	2,583E+04	1,735E+00
2053	0	0	5.130.001	5.643.001	7,296E+03	5,842E+06	3,925E+02	1,949E+03	2,921E+06	1,963E+02	5,347E+03	2,921E+06	1,963E+02	8,376E+01	2,337E+04	1,570E+00
2054	0	0	5.130.001	5.643.001	6,602E+03	5,286E+06	3,552E+02	1,763E+03	2,643E+06	1,776E+02	4,838E+03	2,643E+06	1,776E+02	7,579E+01	2,114E+04	1,421E+00
2055	0	0	5.130.001	5.643.001	5,973E+03	4,783E+06	3,214E+02	1,596E+03	2,392E+06	1,607E+02	4,378E+03	2,392E+06	1,607E+02	6,858E+01	1,913E+04	1,286E+00
2056	0	0	5.130.001	5.643.001	5,405E+03	4,328E+06	2,908E+02	1,444E+03	2,164E+06	1,454E+02	3,961E+03	2,164E+06	1,454E+02	6,205E+01	1,731E+04	1,163E+00
2057	0	0	5.130.001	5.643.001	4,891E+03	3,916E+06	2,631E+02	1,306E+03	1,958E+06	1,316E+02	3,584E+03	1,958E+06	1,316E+02	5,615E+01	1,566E+04	1,052E+00
2058	0	0	5.130.001	5.643.001	4,425E+03	3,543E+06	2,381E+02	1,182E+03	1,772E+06	1,190E+02	3,243E+03	1,772E+06	1,190E+02	5,081E+01	1,417E+04	9,523E-01
2059	0	0	5.130.001	5.643.001	4,004E+03	3,206E+06	2,154E+02	1,070E+03	1,603E+06	1,077E+02	2,935E+03	1,603E+06	1,077E+02	4,597E+01	1,282E+04	8,617E-01
2060	0	0	5.130.001	5.643.001	3,623E+03	2,901E+06	1,949E+02	9,677E+02	1,451E+06	9,746E+01	2,655E+03	1,451E+06	9,746E+01	4,160E+01	1,160E+04	7,797E-01
2061	0	0	5.130.001	5.643.001	3,278E+03	2,625E+06	1,764E+02	8,756E+02	1,313E+06	8,819E+01	2,403E+03	1,313E+06	8,819E+01	3,764E+01	1,050E+04	7,055E-01
2062	0	0	5.130.001	5.643.001	2,966E+03	2,375E+06	1,596E+02	7,923E+02	1,188E+06	7,980E+01	2,174E+03	1,188E+06	7,980E+01	3,406E+01	9,501E+03	6,384E-01
2063	0	0	5.130.001	5.643.001	2,684E+03	2,149E+06	1,444E+02	7,169E+02	1,075E+06	7,220E+01	1,967E+03	1,075E+06	7,220E+01	3,082E+01	8,597E+03	5,776E-01
2064	0	0	5.130.001	5.643.001	2,429E+03	1,945E+06	1,307E+02	6,487E+02	9,723E+05	6,533E+01	1,780E+03	9,723E+05	6,533E+01	2,788E+01	7,779E+03	5,227E-01
2065	0	0	5.130.001	5.643.001	2,197E+03	1,760E+06	1,182E+02	5,870E+02	8,798E+05	5,911E+01	1,610E+03	8,798E+05	5,911E+01	2,523E+01	7,038E+03	4,729E-01
2066	0	0	5.130.001	5.643.001	1,988E+03	1,592E+06	1,070E+02	5,311E+02	7,961E+05	5,349E+01	1,457E+03	7,961E+05	5,349E+01	2,283E+01	6,369E+03	4,279E-01
2067	0	0	5.130.001	5.643.001	1,799E+03	1,441E+06	9,680E+01	4,806E+02	7,203E+05	4,840E+01	1,319E+03	7,203E+05	4,840E+01	2,066E+01	5,763E+03	3,872E-01
2068	0	0	5.130.001	5.643.001	1,628E+03	1,304E+06	8,759E+01	4,348E+02	6,518E+05	4,379E+01	1,193E+03	6,518E+05	4,379E+01	1,869E+01	5,214E+03	3,503E-01
2069	0	0	5.130.001	5.643.001	1,473E+03	1,180E+06	7,925E+01	3,935E+02	5,898E+05	3,963E+01	1,080E+03	5,898E+05	3,963E+01	1,691E+01	4,718E+03	3,170E-01
2070	0	0	5.130.001	5.643.001	1,333E+03	1,067E+06	7,171E+01	3,560E+02	5,336E+05	3,585E+01	9,768E+02	5,336E+05	3,585E+01	1,530E+01	4,269E+03	2,868E-01
2071	0	0	5.130.001	5.643.001	1,206E+03	9,657E+05	6,489E+01	3,221E+02	4,829E+05	3,244E+01	8,839E+02	4,829E+05	3,244E+01	1,385E+01	3,863E+03	2,595E-01
2072	0	0	5.130.001	5.643.001	1,091E+03	8,738E+05	5,871E+01	2,915E+02	4,369E+05	2,936E+01	7,997E+02	4,369E+05	2,936E+01	1,253E+01	3,495E+03	2,348E-01
2073	0	0	5.130.001	5.643.001	9,874E+02	7,906E+05	5,312E+01	2,637E+02	3,953E+05	2,656E+01	7,236E+02	3,953E+05	2,656E+01	1,134E+01	3,163E+03	2,125E-01
2074	0	0	5.130.001	5.643.001	8,934E+02	7,154E+05	4,807E+01	2,386E+02	3,577E+05	2,403E+01	6,548E+02	3,577E+05	2,403E+01	1,026E+01	2,862E+03	1,923E-01
2075	0	0	5.130.001	5.643.001	8,084E+02	6,473E+05	4,349E+01	2,159E+02	3,237E+05	2,175E+01	5,925E+02	3,237E+05	2,175E+01	9,281E+00	2,589E+03	1,740E-01
2076	0	0	5.130.001	5.643.001	7,315E+02	5,857E+05	3,935E+01	1,954E+02	2,929E+05	1,968E+01	5,361E+02	2,929E+05	1,968E+01	8,398E+00	2,343E+03	1,574E-01
2077	0	0	5.130.001	5.643.001	6,619E+02	5,300E+05	3,561E+01	1,768E+02	2,650E+05	1,780E+01	4,851E+02	2,650E+05	1,780E+01	7,599E+00	2,120E+03	1,424E-01

2078	0	0	5.130.001	5.643.001	5,989E+02	4,796E+05	3,222E+01	1,600E+02	2,398E+05	1,611E+01	4,389E+02	2,398E+05	1,611E+01	6,876E+00	1,918E+03	1,289E-01
2079	0	0	5.130.001	5.643.001	5,419E+02	4,339E+05	2,915E+01	1,447E+02	2,170E+05	1,458E+01	3,971E+02	2,170E+05	1,458E+01	6,221E+00	1,736E+03	1,166E-01
2080	0	0	5.130.001	5.643.001	4,903E+02	3,926E+05	2,638E+01	1,310E+02	1,963E+05	1,319E+01	3,593E+02	1,963E+05	1,319E+01	5,629E+00	1,571E+03	1,055E-01
2081	0	0	5.130.001	5.643.001	4,437E+02	3,553E+05	2,387E+01	1,185E+02	1,776E+05	1,194E+01	3,252E+02	1,776E+05	1,194E+01	5,094E+00	1,421E+03	9,548E-02
2082	0	0	5.130.001	5.643.001	4,014E+02	3,215E+05	2,160E+01	1,072E+02	1,607E+05	1,080E+01	2,942E+02	1,607E+05	1,080E+01	4,609E+00	1,286E+03	8,639E-02
2083	0	0	5.130.001	5.643.001	3,632E+02	2,909E+05	1,954E+01	9,702E+01	1,454E+05	9,772E+00	2,662E+02	1,454E+05	9,772E+00	4,170E+00	1,163E+03	7,817E-02
2084	0	0	5.130.001	5.643.001	3,287E+02	2,632E+05	1,768E+01	8,779E+01	1,316E+05	8,842E+00	2,409E+02	1,316E+05	8,842E+00	3,774E+00	1,053E+03	7,073E-02
2085	0	0	5.130.001	5.643.001	2,974E+02	2,381E+05	1,600E+01	7,944E+01	1,191E+05	8,000E+00	2,180E+02	1,191E+05	8,000E+00	3,414E+00	9,526E+02	6,400E-02
2086	0	0	5.130.001	5.643.001	2,691E+02	2,155E+05	1,448E+01	7,188E+01	1,077E+05	7,239E+00	1,972E+02	1,077E+05	7,239E+00	3,089E+00	8,619E+02	5,791E-02
2087	0	0	5.130.001	5.643.001	2,435E+02	1,950E+05	1,310E+01	6,504E+01	9,749E+04	6,550E+00	1,784E+02	9,749E+04	6,550E+00	2,795E+00	7,799E+02	5,240E-02
2088	0	0	5.130.001	5.643.001	2,203E+02	1,764E+05	1,185E+01	5,885E+01	8,821E+04	5,927E+00	1,615E+02	8,821E+04	5,927E+00	2,529E+00	7,057E+02	4,741E-02
2089	0	0	5.130.001	5.643.001	1,993E+02	1,596E+05	1,073E+01	5,325E+01	7,981E+04	5,363E+00	1,461E+02	7,981E+04	5,363E+00	2,289E+00	6,385E+02	4,290E-02
2090	0	0	5.130.001	5.643.001	1,804E+02	1,444E+05	9,705E+00	4,818E+01	7,222E+04	4,852E+00	1,322E+02	7,222E+04	4,852E+00	2,071E+00	5,778E+02	3,882E-02
2091	0	0	5.130.001	5.643.001	1,632E+02	1,307E+05	8,781E+00	4,360E+01	6,535E+04	4,391E+00	1,196E+02	6,535E+04	4,391E+00	1,874E+00	5,228E+02	3,513E-02
2092	0	0	5.130.001	5.643.001	1,477E+02	1,183E+05	7,946E+00	3,945E+01	5,913E+04	3,973E+00	1,082E+02	5,913E+04	3,973E+00	1,696E+00	4,730E+02	3,178E-02
2093	0	0	5.130.001	5.643.001	1,336E+02	1,070E+05	7,190E+00	3,569E+01	5,350E+04	3,595E+00	9,793E+01	5,350E+04	3,595E+00	1,534E+00	4,280E+02	2,876E-02
2094	0	0	5.130.001	5.643.001	1,209E+02	9,682E+04	6,505E+00	3,230E+01	4,841E+04	3,253E+00	8,861E+01	4,841E+04	3,253E+00	1,388E+00	3,873E+02	2,602E-02
2095	0	0	5.130.001	5.643.001	1,094E+02	8,761E+04	5,886E+00	2,922E+01	4,380E+04	2,943E+00	8,018E+01	4,380E+04	2,943E+00	1,256E+00	3,504E+02	2,355E-02
2096	0	0	5.130.001	5.643.001	9,899E+01	7,927E+04	5,326E+00	2,644E+01	3,963E+04	2,663E+00	7,255E+01	3,963E+04	2,663E+00	1,137E+00	3,171E+02	2,130E-02
2097	0	0	5.130.001	5.643.001	8,957E+01	7,173E+04	4,819E+00	2,393E+01	3,586E+04	2,410E+00	6,565E+01	3,586E+04	2,410E+00	1,028E+00	2,869E+02	1,928E-02
2098	0	0	5.130.001	5.643.001	8,105E+01	6,490E+04	4,361E+00	2,165E+01	3,245E+04	2,180E+00	5,940E+01	3,245E+04	2,180E+00	9,305E-01	2,596E+02	1,744E-02
2099	0	0	5.130.001	5.643.001	7,334E+01	5,872E+04	3,946E+00	1,959E+01	2,936E+04	1,973E+00	5,375E+01	2,936E+04	1,973E+00	8,420E-01	2,349E+02	1,578E-02
2100	0	0	5.130.001	5.643.001	6,636E+01	5,314E+04	3,570E+00	1,772E+01	2,657E+04	1,785E+00	4,863E+01	2,657E+04	1,785E+00	7,619E-01	2,125E+02	1,428E-02
2101	0	0	5.130.001	5.643.001	6,004E+01	4,808E+04	3,230E+00	1,604E+01	2,404E+04	1,615E+00	4,400E+01	2,404E+04	1,615E+00	6,894E-01	1,923E+02	1,292E-02
2102	0	0	5.130.001	5.643.001	5,433E+01	4,350E+04	2,923E+00	1,451E+01	2,175E+04	1,462E+00	3,982E+01	2,175E+04	1,462E+00	6,238E-01	1,740E+02	1,169E-02
2103	0	0	5.130.001	5.643.001	4,916E+01	3,936E+04	2,645E+00	1,313E+01	1,968E+04	1,322E+00	3,603E+01	1,968E+04	1,322E+00	5,644E-01	1,575E+02	1,058E-02
2104	0	0	5.130.001	5.643.001	4,448E+01	3,562E+04	2,393E+00	1,188E+01	1,781E+04	1,197E+00	3,260E+01	1,781E+04	1,197E+00	5,107E-01	1,425E+02	9,573E-03
2105	0	0	5.130.001	5.643.001	4,025E+01	3,223E+04	2,165E+00	1,075E+01	1,611E+04	1,083E+00	2,950E+01	1,611E+04	1,083E+00	4,621E-01	1,289E+02	8,662E-03
2106	0	0	5.130.001	5.643.001	3,642E+01	2,916E+04	1,959E+00	9,728E+00	1,458E+04	9,797E-01	2,669E+01	1,458E+04	9,797E-01	4,181E-01	1,166E+02	7,837E-03
2107	0	0	5.130.001	5.643.001	3,295E+01	2,639E+04	1,773E+00	8,802E+00	1,319E+04	8,865E-01	2,415E+01	1,319E+04	8,865E-01	3,783E-01	1,055E+02	7,092E-03
2108	0	0	5.130.001	5.643.001	2,982E+01	2,388E+04	1,604E+00	7,964E+00	1,194E+04	8,021E-01	2,185E+01	1,194E+04	8,021E-01	3,423E-01	9,550E+01	6,417E-03
2109	0	0	5.130.001	5.643.001	2,698E+01	2,160E+04	1,452E+00	7,206E+00	1,080E+04	7,258E-01	1,977E+01	1,080E+04	7,258E-01	3,097E-01	8,641E+01	5,806E-03
2110	0	0	5.130.001	5.643.001	2,441E+01	1,955E+04	1,313E+00	6,521E+00	9,774E+03	6,567E-01	1,789E+01	9,774E+03	6,567E-01	2,803E-01	7,819E+01	5,254E-03
2111	0	0	5.130.001	5.643.001	2,209E+01	1,769E+04	1,188E+00	5,900E+00	8,844E+03	5,942E-01	1,619E+01	8,844E+03	5,942E-01	2,536E-01	7,075E+01	4,754E-03
2112	0	0	5.130.001	5.643.001	1,999E+01	1,600E+04	1,075E+00	5,339E+00	8,002E+03	5,377E-01	1,465E+01	8,002E+03	5,377E-01	2,295E-01	6,402E+01	4,301E-03
2113	0	0	5.130.001	5.643.001	1,808E+01	1,448E+04	9,730E-01	4,831E+00	7,241E+03	4,865E-01	1,325E+01	7,241E+03	4,865E-01	2,076E-01	5,793E+01	3,892E-03
2114	0	0	5.130.001	5.643.001	1,636E+01	1,310E+04	8,804E-01	4,371E+00	6,552E+03	4,402E-01	1,199E+01	6,552E+03	4,402E-01	1,879E-01	5,241E+01	3,522E-03
2115	0	0	5.130.001	5.643.001	1,481E+01	1,186E+04	7,966E-01	3,955E+00	5,928E+03	3,983E-01	1,085E+01	5,928E+03	3,983E-01	1,700E-01	4,743E+01	3,186E-03
2116	0	0	5.130.001	5.643.001	1,340E+01	1,073E+04	7,208E-01	3,579E+00	5,364E+03	3,604E-01	9,819E+00	5,364E+03	3,604E-01	1,538E-01	4,291E+01	2,883E-03
2117	0	0	5.130.001	5.643.001	1,212E+01	9,707E+03	6,522E-01	3,238E+00	4,854E+03	3,261E-01	8,884E+00	4,854E+03	3,261E-01	1,392E-01	3,883E+01	2,609E-03
2118	0	0	5.130.001	5.643.001	1,097E+01	8,783E+03	5,902E-01	2,930E+00	4,392E+03	2,951E-01	8,039E+00	4,392E+03	2,951E-01	1,259E-01	3,513E+01	2,361E-03
2119	0	0	5.130.001	5.643.001	9,925E+00	7,947E+03	5,340E-01	2,651E+00	3,974E+03	2,670E-01	7,274E+00	3,974E+03	2,670E-01	1,139E-01	3,179E+01	2,136E-03
2120	0	0	5.130.001	5.643.001	8,981E+00	7,191E+03	4,832E-01	2,399E+00	3,596E+03	2,416E-01	6,582E+00	3,596E+03	2,416E-01	1,031E-01	2,876E+01	1,933E-03
2121	0	0	5.130.001	5.643.001	8,126E+00	6,507E+03	4,372E-01	2,171E+00	3,253E+03	2,186E-01	5,955E+00	3,253E+03	2,186E-01	9,329E-02	2,603E+01	1,749E-03
2122	0	0	5.130.001	5.643.001	7,353E+00	5,888E+03	3,956E-01	1,964E+00	2,944E+03	1,978E-01	5,389E+00	2,944E+03	1,978E-01	8,442E-02	2,355E+01	1,582E-03
2123	0	0	5.130.001	5.643.001	6,653E+00	5,327E+03	3,579E-01	1,777E+00	2,664E+03	1,790E-01	4,876E+00	2,664E+03	1,790E-01	7,638E-02	2,131E+01	1,432E-03
2124	0	0	5.130.001	5.643.001	6,020E+00	4,820E+03	3,239E-01	1,608E+00	2,410E+03	1,619E-01	4,412E+00	2,410E+03	1,619E-01	6,911E-02	1,928E+01	1,296E-03
2125	0	0	5.130.001	5.643.001	5,447E+00	4,362E+03	2,931E-01	1,455E+00	2,181E+03	1,465E-01	3,992E+00	2,181E+03	1,465E-01	6,254E-02	1,745E+01	1,172E-03
2126	0	0	5.130.001	5.643.001	4,929E+00	3,947E+03	2,652E-01	1,316E+00	1,973E+03	1,326E-01	3,612E+00	1,973E+03	1,326E-01	5,659E-02	1,579E+01	1,061E-03
2127	0	0	5.130.001	5.643.001	4,460E+00	3,571E+03	2,399E-01	1,191E+00	1,786E+03	1,200E-01	3,268E+00	1,786E+03	1,200E-01	5,120E-02	1,428E+01	9,597E-04
2128	0	0	5.130.001	5.643.001	4,035E+00	3,231E+03	2,171E-01	1,078E+00	1,616E+03	1,086E-01	2,957E+00	1,616E+03	1,086E-01	4,633E-02	1,292E+01	8,684E-04
2129	0	0	5.130.001	5.643.001	3,651E+00	2,924E+03	1,964E-01	9,753E-01	1,462E+03	9,822E-02	2,676E+00	1,462E+03	9,822E-02	4,192E-02	1,169E+01	7,858E-04
2130	0	0	5.130.001	5.643.001	3,304E+00	2,645E+03	1,777E-01	8,825E-01	1,323E+03	8,887E-02	2,421E+00	1,323E+03	8,887E-02	3,793E-02	1,058E+01	7,110E-04
2131	0	0	5.130.001	5.643.001	2,989E+00	2,394E+03	1,608E-01	7,985E-01	1,197E+03	8,042E-02	2,191E+00	1,197E+03	8,042E-02	3,432E-02	9,575E+00	6,433E-04
2132	0	0	5.130.001	5.643.001	2,705E+00	2,166E+03	1,455E-01	7,225E-01	1,083E+03	7,276E-02	1,982E+00	1,083E+03	7,276E-02	3,105E-02	8,664E+00	5,821E-04
2133	0	0	5.130.001	5.643.001	2,447E+00	1,960E+03	1,317E-01	6,537E-01	9,799E+02	6,584E-02	1,794E+00	9,799E+02	6,584E-02	2,810E-02	7,839E+00	5,267E-04
2134	0	0	5.130.001	5.643.001	2,215E+00	1,773E+03	1,191E-01	5,915E-01	8,867E+02	5,957E-02	1,623E+00	8,867E+02	5,957E-02	2,543E-02	7,093E+00	4,766E-04
2135	0	0	5.130.001	5.643.001	2,004E+00	1,605E+03	1,078E-01	5,352E-01	8,023E+02	5,391E-02	1,469E+00	8,023E+02	5,391E-02	2,301E-02	6,418E+00	4,312E-04
2136	0	0	5.130.001	5.643.001	1,813E+00	1,452E+03	9,755E-02	4,843E-01	7,259E+02	4,878E-02	1,329E+00	7,259E+02	4,878E-02	2,082E-02	5,807E+00	3,902E-04
2137	0	0	5.130.001	5.643.001	1,641E+00	1,314E+03	8,827E-02	4,382E-01	6,569E+02	4,413E-02	1,202E+00	6,569E+02	4,413E-02	1,884E-02	5,255E+00	3,531E-04
2138	0	0	5.130.001	5.643.001	1,484E+00	1,189E+03	7,987E-02	3,965E-01	5,943E+02	3,993E-02	1,088E+00	5,943E+02	3,993E-02	1,704E-02	4,755E+00	3,195E-04
2139	0	0	5.130.001	5.643.001	1,343E+00	1,076E+03	7,227E-02	3,588E-01	5,378E+02	3,613E-02	9,844E-01	5,378E+02	3,613E-02	1,542E-02	4,302E+00	2,891E-04
2140	0	0	5.130.001	5.643.001	1,215E+00	9,732E+02	6,539E-02	3,246E-01	4,866E+02	3,270E-02	8,907E-01	4,866E+02	3,270E-02	1,395E-02	3,893E+00	2,616E-04
2141	0	0	5.130.001	5.643.001	1,100E+00	8,806E+02	5,917E-02	2,937E-01	4,403E+02	2,958E-02	8,060E-01	4,403E+02	2,958E-02	1,263E-02	3,522E+00	2,367E-04
2142	0	0	5.130.001	5.643.001	9,951E-01	7,968E+02	5,354E-02	2,658E-01	3,984E+02	2,677E-02	7,293E-01	3,984E+02	2,677E-02	1,142E-02	3,187E+00	2,141E-04

Annex 3: LFG Generation

Input data

Project description and time schedule

Short description of project:	Landfill gas (LFG) collection & flaring	
Planned proportion of LFG/methane collected:	%	60%
Commissioning & start of CER generation:	month / year	09 / 2007
Crediting time:	years	3 x 7

Start first crediting period:	01.10.2007
Finish first crediting period:	31.12.2012
Total CERs first crediting period:	**455.082**

Landfill data

Landfill opening:	year	2002
Landfill closure (planned):	year	2031
Waste deposited until the end of 2004:	t	270.001
Annual amount of waste deposited from 2005 until closure:	t / a	180.000
Waste deposited from 2002 until 2031:	t	5.130.001

Process Data

Flare efficiency	%	98%

Waste stream	**Year**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Waste deposited:	t / a	12.750	128.522	128.729	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000	180.000
Cumulative:	t	12.750	141.272	270.001	450.001	630.001	810.001	990.001	1.170.001	1.350.001	1.530.001	1.710.001	1.890.001	2.070.001	2.250.001	2.430.001	2.610.001	2.790.001	2.970.001	3.150.001	3.330.001	3.510.001	3.690.001	3.870.001	4.050.001	4.230.001	4.410.001	4.590.001	4.770.001	4.950.001	5.130.001

Landfill gas (LFG) / Methane generation

Methane generation constant **k**:	1 / a	0,10																													
Methane generation potential L_0:	m^3 / t waste	140																													
Methane content in LFG:	%	50%																													
Calorific value of methane:	MJ / m^3	35,7	equivalent to:		9,92	kWh/m^3 methane,		13.835	kWh/t methane,		4,96	kWh/m^3 LFG,		6.917	kWh/t LFG																	
GWP CH4:	t CO_2 / t CH_4	21																													
Density of methane (standard temperature and pressure):	kg / m^3	0,7168																													
Density of methane (20°C, standard pressure):	kg / m^3	0,6871																													

Baseline

Short description of baseline:		Continuation of existing situation (partial venting only)
Effectiveness Adjustment Factor (EAF):		10%

Results

Model equation:	US EPA first oder decay model

	Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
Total GHG emissions of landfill over time																															
Methane production:	m^3/h	-	19	214	390	828	844	1.039	1.215	1.374	1.519	1.649	1.768	1.874	1.971	2.059	2.138	2.210	2.274	2.333	2.386	2.434	2.478	2.517	2.553	2.585	2.614	2.640	2.664	2.686	2.705
Gas Collection (50% methane):	m^3/h						1.013	1.246	1.458	1.649	1.822	1.979	2.121	2.249	2.365	2.470	2.566	2.652	2.729	2.800	2.863	2.921	2.973	3.021	3.063	3.102	3.137	3.168	3.197	3.223	3.246
Methane collection (80%):	m^3/h						506	623	729	825	911	990	1.061	1.125	1.183	1.235	1.283	1.326	1.365	1.400	1.432	1.461	1.487	1.510	1.532	1.551	1.568	1.584	1.599	1.612	1.623
Methane production:	m^3/a	0	170.716	1.875.314	3.420.469	5.505.076	7.391.306	9.098.038	10.642.953	12.039.707	13.304.085	14.448.141	15.483.326	16.420.000	17.267.538	18.034.422	18.728.328	19.366.199	19.924.321	20.438.379	20.903.617	21.324.392	21.705.215	22.049.799	22.361.590	22.643.711	22.898.985	23.129.966	23.338.966	23.528.077	23.699.192
Methane production:	t CH_4 / a	0	114	1.251	2.282	3.673	4.931	6.070	7.100	8.032	8.876	9.639	10.330	10.955	11.520	12.032	12.495	12.913	13.292	13.635	13.946	14.227	14.481	14.710	14.918	15.107	15.277	15.431	15.571	15.697	15.811
$MD_{project,y}$ = $MD_{reg,y}$ (eff. 98%):	t CH_4 / a	0	0	0	0	0	2.899	3.569	4.175	4.723	5.219	5.668	6.074	6.441	6.774	7.075	7.347	7.593	7.816	8.018	8.200	8.365	8.515	8.650	8.772	8.883	8.983	9.073	9.155	9.230	9.297
$MD_{reg,y}$:	t CH_4 / a	0	0	0	0	0	290	357	417	472	522	567	607	644	677	707	735	759	782	802	820	837	851	865	877	888	898	907	916	923	930
Landfill GHG emissions in CO_2-equivalent	t CO_2 / a	0	2.392	26.273	47.921	77.127	103.553	127.465	149.101	168.678	186.392	202.420	216.923	230.046	241.920	252.664	262.386	271.183	279.142	286.344	292.861	298.757	304.093	308.920	313.288	317.241	320.817	324.054	326.982	329.631	332.028
PEflare,y:	t CO2 / a	0	0	0	0	0	1.243	1.530	1.789	2.024	2.237	2.429	2.603	2.761	2.903	3.032	3.149	3.254	3.350	3.436	3.514	3.585	3.649	3.707	3.759	3.807	3.850	3.889	3.924	3.956	3.984
PEflare,y:	t CH4 / a	0	0	0	0	0	59	73	85	96	107	116	124	131	138	144	150	155	160	164	167	171	174	177	179	181	183	185	187	188	190
Emission Reductions (ER) 2004 - 2024																															
Project emissions (non-flared/combusted):	t CO_2 / a	0	0	0	0	0	41.421	50.986	59.640	67.471	74.557	80.968	86.769	92.018	96.768	101.066	104.954	108.473	111.657	114.538	117.144	119.503	121.637	123.568	125.315	126.896	128.327	129.621	130.793	131.852	132.811
Baseline emissions:	t CO_2 / a	0	2.392	26.273	47.921	77.127	103.553	127.465	149.101	168.678	186.392	202.420	216.923	230.046	241.920	252.664	262.386	271.183	279.142	286.344	292.861	298.757	304.093	308.920	313.288	317.241	320.817	324.054	326.982	329.631	332.028
ER without effectivness adjustment:	**t CO_2 / a**	**0**	**0**	**0**	**0**	**0**	**62.132**	**76.479**	**89.460**	**101.207**	**111.835**	**121.452**	**130.154**	**138.028**	**145.152**	**151.599**	**157.432**	**162.710**	**167.485**	**171.806**	**175.716**	**179.254**	**182.456**	**185.352**	**187.973**	**190.345**	**192.490**	**194.432**	**196.189**	**197.779**	**199.217**
Project emissions (non-flared/combusted) (considering adjustment factor):	t CO_2 / a	0	0	0	0	0	38.397	47.264	55.287	62.546	69.114	75.057	80.435	85.301	89.704	93.688	97.293	100.555	103.506	106.176	108.593	110.779	112.758	114.548	116.167	117.633	118.959	120.159	121.245	122.227	123.116
Baseline emissions (with adjustment factor):	t CO_2 / a	0	2.153	23.646	43.129	69.414	93.198	114.718	134.191	151.810	167.753	182.178	195.231	207.042	217.728	227.398	236.147	244.064	251.228	257.710	263.575	268.881	273.683	278.028	281.960	285.517	288.736	291.648	294.283	296.668	298.826
ER_y:	t CO_2 / a	0	0	0	0	0	54.800	67.454	78.904	89.264	98.639	107.121	114.796	121.748	128.024	133.710	138.855	143.510	147.722	151.533	154.982	158.102	160.926	163.481	165.792	167.884	169.777	171.489	173.039	174.441	175.709
ER first crediting period:	**t CO_2 / a**						**13.700**	**67.454**	**78.904**	**89.264**	**98.639**	**107.121**	**114.796**	**91.305**	**128.024**	**133.710**	**138.855**	**143.510**	**147.722**	**151.533**	**154.982**	**158.102**	**160.926**	**163.481**	**165.792**	**167.884**	**169.777**	**171.489**	**173.039**	**174.441**	**175.709**
Methane collection:	**m^3/a**						1.108.696	5.458.823	6.385.412	7.223.824	7.982.451	8.668.885	9.289.996	7.389.000	10.360.523	10.820.653	11.236.997	11.613.720	11.954.592	12.263.027	12.542.110	12.794.635	13.023.129	13.229.879	13.416.954	13.586.227	13.739.391	13.877.979	14.003.380	14.116.846	14.219.515

Methane collection first crediting period:	**m3**	**46.939.567**

Annex 4

MONITORING INFORMATION

Summary of Monitoring Approach

The monitoring will be carried out as described in Section B.7 of this PDD, and in line with ACM0001. The basic approach is to monitor on a continuous basis the amount of methane destroyed through flaring and combustion. The main parameters to be monitored include:

- Total flow of captured landfill gas [Nm^3]
- Landfill gas flow to flare [Nm^3]
- Landfill gas consumed in the power plant [Nm^3] (only if the power plant is built)
- Methane fraction in the landfill gas [m^3 CH4 / m^3 LFG]
- Landfill gas temperature [ºC]
- Landfill gas pressure [Pa]
- Amount of electricity imported by the project [MWh]
- Amount of electricity exported to the grid [MWh] (only if the power plant is built)
- Operation of the energy plant [h] (only if the power plant is built)
- Flare operation time [h]
- Volumetric fraction of components in the residual gas [% CH_4, O_2]
- Volumetric fraction of O2 in the exhaust gas
- Concentration of methane in the exhaust gas [mg/m^3]
- Volumetric flow rate of the residual gas [m^3/h]
- Temperature in the exhaust gas of the flare [ºC]

Landfill gas flows to flare and its component (CH_4, O_2) contents will be determined on a continuous basis. Volumetric fraction of O_2 and concentration of methane in the exhaust gas will be measured continuously. The same applies for the flare operation time and energy plant operation time (if the energy plant is built). Landfill gas flows will be converted to norm cubic meters (Nm^3) using continuous measurements of pressure and temperature.

The amount of flared methane will be calculated from the flow of landfill gas to the flare, the methane and oxygen content of the landfill gas sent to the flare (residual gas), the methane concentration and the volumetric fraction of oxygen in the exhaust gas, and temperature of the exhaust gas. Hence, project emissions from flaring of the residual gas stream [tCO2e] will be continuously determined.

The precise procedures for the monitoring will be documented in a manual, and the responsible staff will be identified and adequately trained. Key elements of the manual will include:

- Division of responsibilities between staff
- Reading of meters and analysers (method, frequency)
- Data handling and storage
- Data analysis and reporting
- Maintenance and calibration of meters and analysers
- QA / QC procedures, including internal reviews

Some details on the proposed procedures are provided below.

Quality control and quality assurance procedures
Regarding quality control and quality assurance procedures to be undertaken for the monitored data, the practices to be implemented in the context of the project at CTRVV landfill are as follows:

Plausibility testing of data
The plausibility of all collected data will be tested on a routine basis with respect to:

- Consistency with previous measurements (time-series)
- Deviations from *ex ante* estimations of emission reductions

Any inconsistencies or implausibilities will be resolved immediately. If required, suggestions for the improvement of the monitoring system will be formulated and implemented.

Equipment calibration and maintenance
All meters and other sensors will be subject to regular maintenance and testing regime according to the technical specifications from the manufacturers to ensure accuracy and good performance.
Calibration of equipment will be performed periodically according to technical specifications and in agreement with the requirements of INMETRO (Metrology National Institute), norms applied to ABNT and the precision requirements established in the used equipment Maintenance Plan. Whenever applicable, the calibration will be carried out by qualified companies/entities with recognized experience in the market in this activity, using methods and instruments traceable to international standards of quality.
A maintenance plan will be elaborated with the aim of obtaining the optimum performance and regularity of the system operation, covering at least the following aspects: frequency of equipment preventive maintenance, maintenance procedures detailed according to technical specifications of the equipment manufacturers, when applicable; frequency of equipment calibration, specially of those responsible for the measurement of data to be monitored and routines of periodical check ups to verify the functioning and performance of the equipment.

Internal Audits
As described in Section B.7., all monitoring data will undergo an internal review before being submitted to the designated operational entity for independent verification. During these reviews the records will be checked by two internal staff members that are not involved in the actual data recording. The two reviewers will a) double-check the quality of the data recorded and b) audit the GHG project compliance with operational and monitoring requirements. If a need for corrective action is identified, they will propose the same to the management of CTRVV. The reviewers will summarize their findings in written form.

During the internal audits, all sustainable development indicators will be measured and formally registered.

Corrective, Preventive and Improvement Actions

The CTRVV Landfill administration (Valdir Damo) will be responsible for the project management.

Actions to handle and correct deviations from the Monitoring Plan and Operational Manual procedures will be implemented as these deviations are observed either by the operator or during internal audits. If necessary, technical meetings between the operator, the developer and the sponsor of the project will be held in order to define the corrective actions to be undertaken.

The quality guarantee measures include procedures for treating and correcting non-conformities in the implementation of the Project and in the operation and maintenance of the System. If such non-conformities are detected, specially those related to the corrective maintenance of the equipment:

1) An analysis of the non-conformity and its causes will be conducted immediately by the CTRVV Landfill staff;
2) The CTRVV Landfill administration will make a decision about the corrective actions adequate to eliminate the non-conformity and its causes;
3) Corrective actions are implemented and reported to the Landfill administration.
4) If non-conformities that might occur are detected, a similar procedure will be adopted on Preventive Action taking and register.
5) On the other hand, improvements that might be incorporated in the process will be registered and followed through Improvement Actions.

Training

The operational staff will be trained in equipment operation, data recording, reports writing, and operation, maintenance and emergency procedures in compliance with the Operational Manual.

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