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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

URBAM/ARAUNA - Landfill Gas Project (UALGP)
Version 09
Date: 07/04/2007

A.2. Description of the project activity:

The purpose of URBAM/ARAUNA - Landfill Gas Project is to capture and burn greenhouse gases emissions due to the garbage decomposition. For attaining this objective, project was defined in 6 stages, as follows:

1 – PDD conception and validation within established UNFCCC rules.
2 – PDD and validation report subscription to DNA approval.
3 – Registering the project on the Executive Board of UNFCCC.
4 – Implement the Project infrastructure.
5 – Verify project and start operation and monitoring.
6 – Certify, periodically, the project until the end of crediting period.

Stages are being planned to flow sequentially. Stage 4 timing may be changed due to investments decisions.

The First Crediting Period planned for this project has the duration of 7 years, renewable twice.

The purpose for project activity is to reduce greenhouse gas emissions on atmosphere, justifying the needed investments trough Certified Emissions Reduction (CERs). CDM was the path found for project viability. As demonstrated on the item B.5. Tool of Additionality CDM is the only viable scenery that would reduce the emission on the landfill.

The Project Activity will reduce the GHG emissions through the implementation of an active landfill gas capturing system. Such a system is common on Europeans and North American landfills, making the technology well developed and simple.

Nor Brazilian State or County legislation requires the gas to be captured, burned or used and there is no perception on intention to do so. The authorities focus is to improve the adequacy of the dumping to avoid that the environment contamination by lechate leakage from waste residues reaching water and soil.

The only obligation to capture or burn the gas is due the high risk of explosion, and the common systems implemented are passive venting system which do not have the efficiency to capture a significant amount of gas. Usually the captured gas is not intentionally burned, which causes the disposal of methane directly to the atmosphere.
The implementation of such a project incurs in financial costs and since there are no laws to enforce those reductions there are no reasons to believe that such projects would happen without the Kyoto protocol and the CDM projects.

The view of project participants of the contribution of the project activity to sustainable development:

a) Urbanizadora Municipal S/A - URBAM

URBAM Landfill is a medium sized Landfill in the most economically important State In Brazil. São Paulo State Companies practices are very often seeing as example for other companies in the Country. According to Mr. Felício Ramuth, URBAM's President-Director. "We can't wait to implement the CDM project in URBAM Landfill. We want our community to be proud of it and give the environment the respect it needs to continue giving us our life conditions. We hope to be a good reference on CDM. URBAM project in São José dos Campos will, not only improve environmental preservation but generate new activities in landfill dependencies, raise the knowledge regarding environmental care, improve work conditions through the Sustainable Development."

b) Araúna Participações e Investimentos Ltda

Araúna Participações e Investimentos Ltda is dedicating its efforts and investing in CDM Projects under Kyoto Protocol and has the willing to establish and spread the Sustainable Development. According to Mr. Maurício Roberto Maruca, Araúna's Partner-Director "the expectations is to growth the initiative and fight GHG emissions before its too late. If Corporations strategy definitions are reasonable, sustainable development should be the trend for next fifty years, and CDM is a way of making it".

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	• URBAM – Urbanizadora Municipal S.A. (Public Entity) • Araúna Participações e Investimentos Ltda (Private Entity)	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.		

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.:

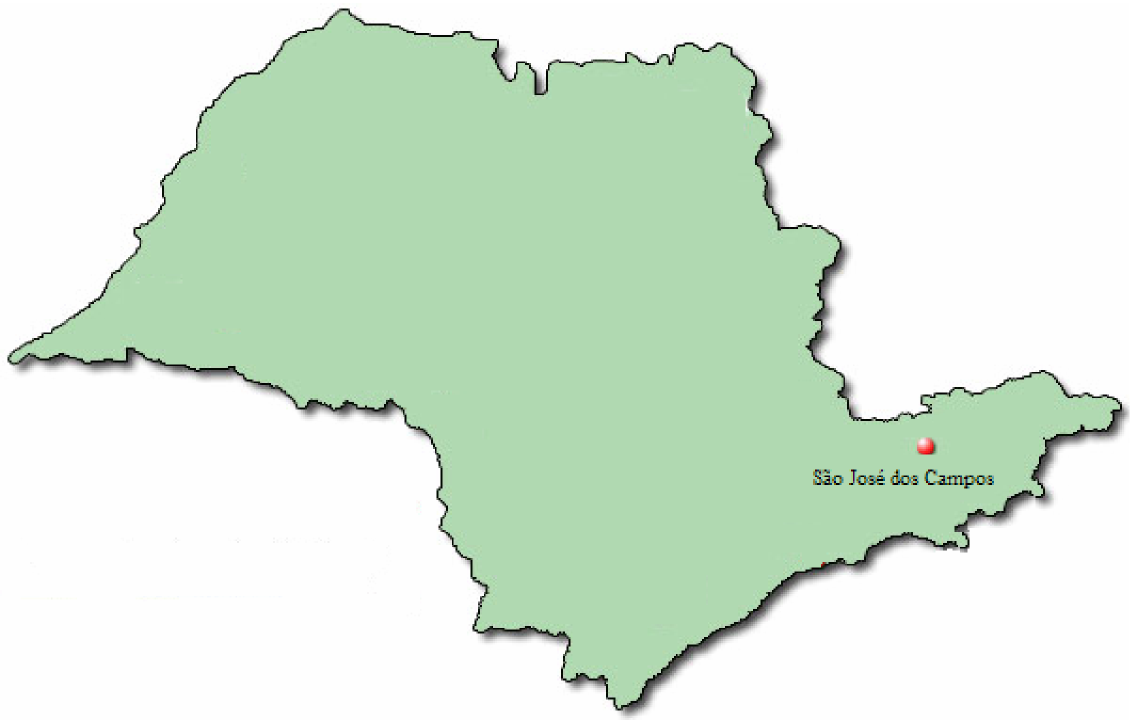
- State of São Paulo.

A.4.1.3. City/Town/Community etc:

- City of São José dos Campos.

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

- Estrada Municipal do Torrão de Ouros/n^{o} – Bairro Torrão de Ouro – São José dos Campos - São Paulo, Brazil ZIP Code 12.231-790



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

- Waste handling and disposal. Scope number 13.

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

The technology to be used in the project activity is available in the Brazilian market, consisting basically of a vertical drains system interconnected to horizontal tubing which is connected to the suction and flaring equipment. This materials and equipment are made in Brazil.

Companies that design and build flares usually operate in wider markets such as combustion, landfill technology or environmental engineering, since the market generated by the CDM projects, such as UALGP, is still small. However, the interaction with Brazilian companies make noticeable the growing interest on this new market, which means that those projects are stimulating the capturing and flaring systems market. Also Global companies which manufacture many units per annum are interested on the Brazilian New market, which is definitely helping to improve the Brazilian knowledge on active landfill gas capturing.

The technology for the collected landfill gas flaring includes:

- Enclosed Biogas flare with about 90% of efficiency;
- Blower systems to force the landfill gas out of the landfill;
- Automated monitoring system;
- Automated system controlling flare adjustments, blowers speed and alarm system in failure case.
- Engine that runs on landfill gas, acting as a source of energy (generator);
- Gas filtering and drying system which the collection system will go through to avoid excessive liquids in the blower, generator and flare;
- Horizontal pipes to collect the landfill gas;
- Vertical drains on the waste to extract the landfill gas;

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

The period of credit chosen is 7 years. In the table below it is shown the emissions reductions for the first crediting period.

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emission reductions shall be in using the following tabular format	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2008	107.946
2009	111.195
2010	114.271
2011	117.190
2012	119.970
2013	122.624
2014	125.167
Total estimated reductions (tonnes of CO_2e)	**818.362**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**116.909**

A.4.5. Public funding of the project activity:

There is no public financing for the project activity.

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:

Approved consolidated baseline methodology ACM0001 (version 05):
"Consolidated baseline methodology for landfill gas project activities".

The ACM0001 draws upon:

- "Tool for demonstration and assessment of additionality" latest version (version 03)
- "Tool to determine project emissions from flaring gases containing methane."

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

The ACM0001 methodology 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 situations such as:

a) The captured gas is flared; or

b) The captured gas is used to produce energy (e.g. electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources; or

c) The captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources. In this case a baseline methodology for electricity and/or thermal energy displaced shall be provided or an approved one used, including the ACM0002 "Consolidated Methodology for Grid-Connected Power Generation from Renewable". If capacity of electricity generated is less than 15MW, and/or thermal energy displaced is less than 54 TJ (15GWh), small-scale methodologies can be used.

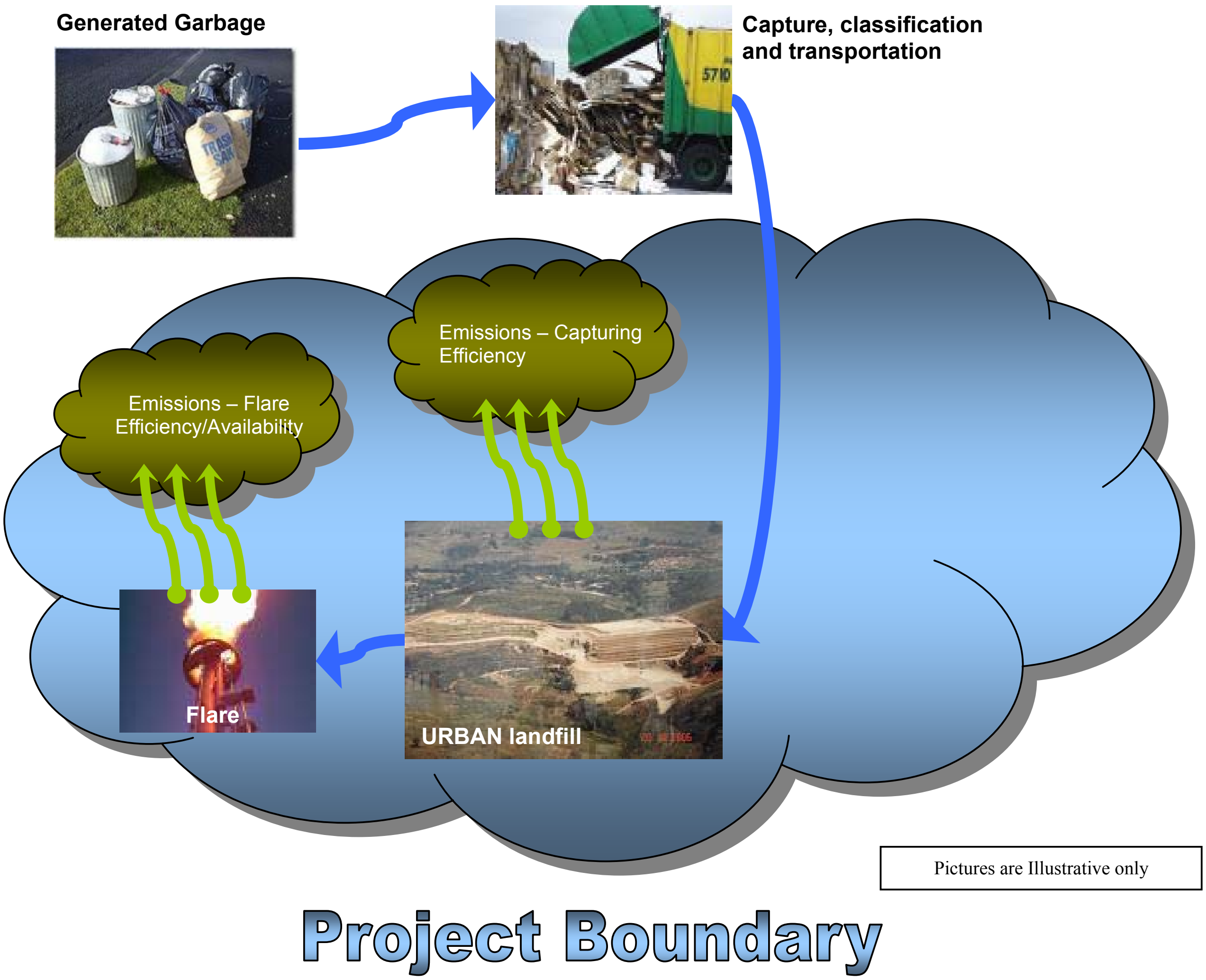
As the UALGP project activity fits the second item, since the project consists in simple capture and flare the gas generated by the landfill, the methodology is applicable to this project activity. And all the energy to support the project activity will be generated on landfill gas engines, but no emissions reductions will be claimed from displace energy from other sources.
The Environmental documentation is on annex 3 showing that there are no legal requirements, allowing the project to be implemented as above.

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

	Source	Gas	Included?	Justification/ Explanation
Baseline	Machinery Diesel Consumption	CO_2	No	Baseline and Project Activity emissions are the same.
		CH_4	No	Baseline and Project Activity emissions are the same.
		N_2O	No	Baseline and Project Activity emissions are the same.
	Electricity for the infrastructure	CO_2	No	Baseline and Project Activity emissions are the same.
		CH_4	No	Baseline and Project Activity emissions are the same.
		N_2O	No	Baseline and Project Activity emissions are the same.
	Methane Emission due to decomposition of organic waste	CO_2	No	Baseline and Project Activity emissions are the same.
		CH_4	**Yes**	**Main source of GHG emission on a landfill.**
		N_2O	No	Project Activity emissions are a little smaller then Baseline.
Project Activity	Machinery Diesel Consumption	CO_2	No	Baseline and Project Activity emissions are the same.
		CH_4	No	Baseline and Project Activity emissions are the same.
		N_2O	No	Baseline and Project Activity emissions are the same.
	Electricity for the infrastructure	CO_2	No	Baseline and Project Activity emissions are the same.
		CH_4	No	Baseline and Project Activity emissions are the same.
		N_2O	No	Baseline and Project Activity emissions are the same.
	Additional Electricity for the infrastructure	CO_2	No	All the needed electricity will be produced with landfill gas.
		CH_4	No	Not Relevant.
		N_2O	No	Not Relevant.
	Methane Emission due to decomposition of organic waste	CO_2	No	Baseline and Project Activity emissions are the same.
		CH_4	**Yes**	**Methane that will not be captured or burned.**
		N_2O	No	Project Activity emissions are a little smaller then Baseline.

The project boundary is the site of the project activity where the gas is captured and destroyed/used.

The project boundary is limited to the area currently occupied by URBAN landfill because there are no emissions that might be attributed to the project activities that are outside its perimeter.



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

The most probable alternatives are:

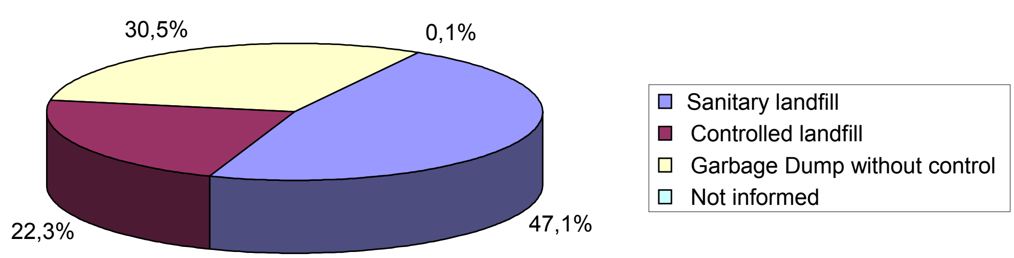
- Alternative 1: The landfill operator would invest in LFG capture and flaring not undertaken as a CDM project activity. Due to the current Brazilian legislation, the location and conditions of the landfill, the achievement of Alternative 1 above is not probable. It would not be an economically attractive course of action for the landowner nor for the landfill operator. Therefore its adoption is not plausible.

- Alternative 2: The landfill operator would maintain the present activities according to the common practice of not flaring the landfill gas from its landfill operations, since there are no regulations regarding the emissions of methane. This is the most plausible course of action if the project activity is not considered.

- Alternative 3: The landfill operator would invest in LFG capture and utilization to produce electricity or for commercial purposes.
  The LFG do not produce enough energy to make return on investment (ROI) to produce electricity for commercial purpose. Regarding that fact there are several constrains due to electricity distribution market complexity, which are not the core business of landfill Owner.

According to the 2000 National Research on Sanitation (Pesquisa Nacional de Saneameto Básico 2000), made by IBGE (Instituto Brasileiro de Geografia e Estatística - Statistics and Geographic Brazilian Institute), from a total estimated volume of garbage collected in Brazil (161,827.1 t/day) 47.1% of the collected garbage was dumped on sanitary landfills, 22.3% was dumped on “controlled” landfills and 30.5% was dumped on “Garbage dumping sites” without any control.

Waste destination in Brazil (% from the collected waste)



Nor Brazilian State or County legislation requires the gas to be captured, burned or used and there is no perception on intention to do so. The focus is to improve the adequacy of the dumping to avoid that the environment contamination by leakage of lechate from the waste residues. This can be noticed by the improve that occurred through the last years, since in 1989 only 10,7% of the collected garbage was dumped on Sanitary or Controlled landfills against 69% in the year 2000 (see above).

There are no obligations to efficiently capture or burn the gas, the capturing and flaring existing systems are due high risk of explosion. The common systems implemented are passive venting systems which do not have the efficiency to capture or burn a significant amount of gas. Usually the captured gas is not intentionally burned, which causes the disposal of methane directly to the atmosphere.

The implementation of such a project incurs in financial costs that undermine the intention on reducing theses GHG emissions. Since there are no laws to enforce those reductions there are no reason to believe that such projects would happen without the Kyoto Protocol and the CDM projects.

Generating electricity for commercial purpose demands big investments, as the Brazilian electricity market still have several constrains due to distribution market complexity, and the Brazilian interests are still, about 13,25% per year (dec/06) the ROI (return on investment) is still not attractive for mid size landfills such as URBAM Landfill.

As there is no attractiveness on alternatives that would reduce the GHG emissions on landfills like URBAM landfill, the current scenario is the most probable, which lead to the choice of the baseline.

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): >>

ACM0001 requires the use of the "Tool for demonstration and assessment of additionality" version 3 to prove the project is not the baseline scenario. This tool is applied as follows.

Preliminary screening based on the starting date of the project activity

The Project Participants do not wish to have the crediting period starting prior to the registration of their project activity. The project activity will start on 01/07/2007 and the first crediting period is scheduled to 01/07/2008, after the registration of the project.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

The alternatives to the project activity are:

- Alternative 1: The landfill operator would invest in LFG capture and flaring not undertaken as a CDM project activity. Due to the current Brazilian legislation, the location and conditions of the landfill, the achievement of Option 1 above is not probable. It would not be an economically attractive course of action for the landowner nor for the landfill operator. Therefore its adoption is not plausible.

- Alternative 2: The landfill operator would maintain the present activities according to the common practice of not flaring the landfill gas from its landfill operations, since there are no regulations regarding the emissions of methane. This is the most plausible course of action if the project activity is not considered.

- Alternative 3: The landfill operator would invest in LFG capture and utilization to produce electricity or for commercial purposes.
  The LFG do not produce enough energy to make return on investment (ROI) to produce electricity for commercial purpose. Regarding that fact there are several constrains due to electricity distribution market complexity, which are not the core business of landfill Owner.

Sub-step 1b. Consistency with mandatory laws and regulations:

- Alternative 1: The alternative 1 is compliance to all applicable laws and regulations as explicated in this sub-step on the Project Activity item, since this alternative is similar to the project activity, but is not undertaken as a CDM project activity.

- Alternative 2: The present activities are also in compliance with all applicable laws and regulations as shown through the documentation sent to DOE.

- Alternative 3: The commercialization of electricity generated by landfill gas is possible to be done in accordance to applicable laws and regulations to the landfill operation as much as to the distribution of electricity to the grid, as seen on Bagasse cogeneration CDM projects. However, in the case of URBAM landfill the financial return would not be sufficient to encourage landfill owner or landfill operator to implement such a project.

- Project Activity: In the present context the proposed baseline scenario might be described like this:

There is no active gas capture and treatment in the site, only a passive ventilation system, that occasionally burns the landfill gas; thus, the release of the landfill gas without obstacles would continue in these guidelines until a time in the future when the capture and treatment of landfill gas could be required by law or could become an economically attractive course of action. These alterations in the possible future of the baseline will be followed by a monitoring plan elaborated for the project.

This scenario is the base for the definition of the emission reductions of the project. Due to the uncertainty of the gas volume to be captured by the current ventilation system, it's affirmed that the volume of captured gas is low, since most of the methane is generated in the deeper layers of the landfill, and most of the landfill gas escape through the skirts of the landfill. The gas flux in the top of the upper layers (where the decomposition is mostly aerobic) is so low that flaring is not always possible, verifying mostly the ventilation. The existing contractual documents do not determine capturing or flaring the gas. On the landfill there is an implemented venting system that does not, adequately, support the burning of the LFG. So, it is reasonable to assume that a very low volume of gas will be flared.

As shown in A.4.4, Brazil does not have any law to mitigate landfill gas emissions. In São Paulo State, CETESB - Companhia de Tecnologia de Saneamento Ambiental, the environmental agency, has been acting towards closing rubbish dumps and forcing municipalities to give proper destination to the generated waste. That may be done through concessions to private entities either to build and operate sanitary landfills or to be responsible for the whole municipality's waste management. In all cases, however, active collection and flaring of the landfill gas has never been required.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Since there is no intention to produce electricity commercially, and there will be no profitable activities neither cost reduction on the project. The Option I – simple cost analysis – is chosen.

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

The URBAM landfill operates without efficiently flaring the LFG. There are no reasons to believe that a more efficient LFG capturing and flaring systems would be installed for safety, operational reasons or odor problems. The installation of a LFG capture and flaring system, even an inefficient one, would require costs for the landfill owner with no sort of financial compensation, compromising its business viability.

Since the flaring of the gases represent an effort to improve the environmental quality of the landfill, without the generation of energy or any sub-products of the activity that might bring profit or dividends, the project does not present economically attractive results.

Estimated costs from project implementation and operation:

URBAM/Arauna Landfill Gas Project (UALGP)				
Estimated Expenses to implement and operate the project				
	Implementation	7	14	21
Stated Period		0 to 7 years	8 to 14 years	15 to 21 years
Preliminary costs, PDD, Construction Projects, Mechanical Projects, etc	€ 146.886,00	€ 4.459,00	€ 83.207,00	€ 83.207,00
Construction Work	€ 424.525,00	€ 29.715,00	€ 29.715,00	€ 29.715,00
Validation, Certification and UNFCCC taxes	€ 60.000,00	€ 35.000,00	€ 95.000,00	€ 95.000,00
Administration, operation, maintenance and monitoring	€ 0,00	€ 483.156,00	€ 483.156,00	€ 483.156,00
Security and surveillance	€ 0,00	€ 194.040,00	€ 194.040,00	€ 194.040,00
Financial Expenses	€ 95.155,00	€ 46.050,00	€ 5.825,00	€ 5.825,00
Insurances	€ 8.491,00	€ 54.084,00	€ 54.084,00	€ 54.084,00
Total Annual Expenses	€ 735.057,00	€ 846.504,00	€ 945.027,00	€ 945.027,00
Accumulated Expenses	**€ 735.057,00**	**€ 1.581.561,00**	**€ 2.526.588,00**	**€ 3.471.615,00**

Step 3. Barrier Analysis

Not Applicable

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

Not Applicable

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

Not Applicable

Step 4. Common practice analysis

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

There is no similar activities to UALGP, without consider other similar CDM projects, being carried out in Brazil at the current moment.

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

Considering that there is no similar activities widely observed and commonly carried out, it is not possible to perform an analysis at this point.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

As explained above the applicability of the methodology is adequate to the project activity proposed in this PDD due:

The ACM0001 methodology 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 situations such as:

a) The captured gas is flared; or

b) The captured gas is used to produce energy (e.g. electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources; or

c) The captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources. In this case a baseline methodology for electricity and/or thermal energy displaced shall be provided or an approved one used, including the ACM0002 "Consolidated Methodology for Grid-Connected Power Generation from Renewable". If capacity of electricity generated is less than 15MW, and/or thermal energy displaced is less than 54 TJ (15GWh), small-scale methodologies can be used.

As the UALGP project activity fits the second item, since the project consists in simple capture and flare the gas generated by the landfill and produce energy for the project activity use only, the methodology is applicable to this project activity.
As specified by the methodology the emission reduction of CO_2e shall be calculated as follows:

$$ER_Y = (MD_{project,y} - MD_{reg,y}) \cdot GWP_{CH4} + EL_y \cdot CEF_{electricitry} - ET_y \cdot CEF_{termal}$$

Where:

ER_Y - Emission reduction in a given year "y", in tonnes of CO_2 equivalent (tCO_2e)

$MD_{project,y}$ - The amount of methane that would have been destroyed/combusted by the project activity during the year, in,tonnes 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, tonnes 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).

$CEF_{electricitry}$ - CO_2 emissions intensity of the electricity displaced, in tCO_2e/MWh. Since all the electricity used by the project will be produced by landfill gas the grid electricity emission is not relevant for the UALGP.

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_{termal} - CO_2 emissions intensity of the fuel used to generate thermal/mechanical energy, in tCO_2e/TJ

In this specific project there will be neither thermal energy production nor electricity production, so the followings components of the equation will not generate emission reductions:

$ET_y = 0$

EL_y, thought it will not generate emission reductions it shall be calculated to discount the increase of CO_2e emission due to the increase of electricity use, and is calculated as:

$$EL_y = EL_{EX,LGFG} - EL_{IMP}$$

Where:

$EL_{EX,LGFG}$ - 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 this project no electricity will be imported.

considering that $EL_{EX,LGFG}=0$ since there is no electricity export in the project.

$EL_{IMP}= EF_{electricity}$ X Electricity consumption over 7 years

Electricity consumption over 7 years = *0*

EL_{IMP} = 0MWh.

There are no regulatory or contractual requirements specifying $MD_{reg,y}$ the "Adjustment Factor", and the equation that shall be used is:

$$MD_{reg,y} = MD_{project,y} \cdot AF$$

Regarding the flare efficiency the choice, in compliance with "Tool to determine project emissions from flaring gases containing methane", is to continuous monitor the methane destruction efficiency of the enclosed flare (the Flare efficiency) planed for this project:

The tool involves the following seven steps:
STEP 1: Determination of the mass flow rate of the residual gas that is flared
STEP 2: Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas
STEP 3: Determination of the volumetric flow rate of the exhaust gas on a dry basis
STEP 4: Determination of methane mass flow rate of the exhaust gas on a dry basis
STEP 5: Determination of methane mass flow rate of the residual gas on a dry basis
STEP 6: Determination of the hourly flare efficiency
STEP 7: Calculation of annual project emissions from flaring based on measured hourly values or based on default flare efficiencies.

Project participants shall apply these steps to calculate project emissions from flaring ($PE_{flare,y}$) based on the measured hourly flare efficiency or based on the default values for the flare efficiency ($\eta_{flare,h}$).

The calculation procedure in this tool determines the flow rate of methane before and after the destruction in the flare, taking into account the amount of air supplied to the combustion reaction and the exhaust gas composition (oxygen and methane). The flare efficiency is calculated for each hour of a year based either on measurements or default values plus operational parameters. Project emissions are determined by multiplying the methane flow rate in the residual gas with the flare efficiency for each hour of the year.

STEP 1. Determination of the mass flow rate of the residual gas that is flared

This step calculates the residual gas mass flow rate in each hour *h*, based on the volumetric flow rate and the density of the residual gas. The density of the residual gas is determined based on the volumetric fraction of all components in the gas.

$$FM_{RG,h} = \rho_{RG,h} \times FV_{RG,h}$$

$FM_{RG,h}$ - kg/h Mass Flow rate of residual gas in hour *h;*

$\rho_{RG,h}$ - kg/m^3 Density of residual gas at normal conditions in hour *h*;

$FV_{RG,h}$ - m^3/h Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*

And:

$$\rho_{RG,n,h} = \frac{P_n}{\frac{R_u}{MM_{RG,h} \times T_n}}$$

$\rho_{RG,n,h}$ - kg/m3 Density of the residual gas at normal conditions in hour *h*

P_n - Pa Atmospheric pressure at normal conditions (101 325)

R_u - Pa.m^3/kmol.K Universal ideal gas constant (8 314)

$MM_{RG,h}$ - kg/kmol Molecular mass of the residual gas in hour *h*

T_n -K Temperature at normal conditions (273.15)

$$MM_{RG,h} = \sum_i (fv_{i,h} * MM_i)$$

$MM_{RG,h}$ - kg/kmol Molecular mass of the residual gas in hour *h*

$fv_{i,h}$ - Volumetric fraction of component i in the residual gas in the hour *h*

MM_i -kg/kmol Molecular mass of residual gas component i

I - The components CH4, CO, CO2, O2,H2, N2

As a simplified approach, project participants may only measure the volumetric fraction of methane and consider the difference to 100% as being nitrogen (N2).

STEP 2. Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas

Determination of the mass fraction of carbon, hydrogen, oxygen and nitrogen in the residual gas, calculated from the volumetric fraction of each component *i* in the residual gas, as follows:

$$fm_{j,h} = \frac{\sum_i fv_{i,h} \cdot AM_j \cdot NA_{j,i}}{MM_{RgG,h}}$$

$fm_{i,h}$ - Mass fraction of element j in the residual gas in hour *h*

$fv_{i,h}$ - Volumetric fraction of component i in the residual gas in the hour *h*

AM_j -kg/kmol Atomic mass of element j

$NA_{j,i}$ - Number of atoms of element j in component i

$MM_{RG,h}$ - kg/kmol Molecular mass of the residual gas in hour *h*

j - The elements carbon, hydrogen, oxygen and nitrogen

i - The components CH4, CO, CO2, O2,H2, N2

STEP 3. Determination of the volumetric flow rate of the exhaust gas on a dry basis

This step is applicable to this project as the methane combustion efficiency of the flare is continuously monitored.

Determine the average volumetric flow rate of the exhaust gas in each hour *h* based on a stoichiometric calculation of the combustion process, which depends on the chemical composition of the residual gas, the amount of air supplied to combust it and the composition of the exhaust gas, as follows:

$$TV_{n,FG,h} = V_{n,FG,h} \times FM_{RG,h}$$

$TV_{n,FG,h}$ - m3/h - Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour *h*

$V_{n,FG,h}$ - m3/kg residual gas - Volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in hour *h*

$FM_{RG,h}$ - kg residual gas/h - Mass flow rate of the residual gas in the hour *h*

$$V_{n,FG,h} = V_{n,CO_2,h} + V_{n,O_2,h} + V_{n,N_2,h}$$

$V_{n,FG,h}$ - m3/kg residual gas - Volume of the exhaust gas of the flare in dry basis at normal conditions per kg of residual gas in the hour *h*

$V_{n,CO2,h}$ - m3/kg residual gas - Quantity of CO2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour *h*

$V_{n,N2,h}$ - m3/kg residual gas -Quantity of N2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour *h*

$V_{n,O2,h}$ - m3/kg residual gas - Quantity of O2 volume free in the exhaust gas of the flare

$$V_{n,O_2,h} = n_{O_2,h} \times MV_n$$

$V_{n,O2,h}$ - m3/kg residual gas - Quantity of O2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour *h*

$n_{O2,h}$ - kmol/kg residual gas - Quantity of moles O2 in the exhaust gas of the flare per kg residual gas flared in hour *h*

MV_n - m3/kmol -Volume of one mole of any ideal gas at normal temperature and pressure (22.4 L/mol)

$$V_{n,N_2,h} = MV_n * \left\{ \frac{fm_{N,h}}{200 AM_N} + \left(\frac{1 - MF_{O_2}}{MF_{O_2}} \right) * \left[F_h + n_{O_2,h} \right] \right\}$$

$V_{n,N2,h}$ - m3/kg residual gas - Quantity of N_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour *h*

MV_n - m3/kmol - Volume of one mole of any ideal gas at normal temperature and pressure (22.4 m3/Kmol)

$fm_{N,h}$ - Mass fraction of nitrogen in the residual gas in the hour *h*

AM_n - kg/kmol - Atomic mass of nitrogen

MF_{O2} - O_2 volumetric fraction of air

F_h - kmol/kg residual gas - Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour *h*

$n_{O2,h}$ - kmol/kg residual gas - Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour *h*

$$V_{n,CO_2,h} = \frac{fm_{C,h}}{AM_C} * MV_n$$

$V_{n,CO2,h}$ - m3/kg residual gas - Quantity of CO_2 volume free in the exhaust gas of the flare at normal conditions per kg of residual gas in the hour *h*

$fm_{C,h}$ - Mass fraction of carbon in the residual gas in the hour *h*

AM_C - kg/kmol - Atomic mass of carbon

MV_n - m3/kmol - Volume of one mole of any ideal gas at normal temperature and pressure (22.4 m3/Kmol)

$$n_{O_2,h} = \frac{t_{O_2,h}}{\left\{1 - \left(t_{O_2,h} / MF_{O_2}\right)\right\}} \times \left[\frac{fm_{C,h}}{AM_C} + \frac{fm_{N,h}}{2AM_N} + \left(\frac{1 - MF_{O_2}}{MF_{O_2}}\right) \times F_h\right]$$

$n_{O2,h}$ - kmol/kg residual gás - Quantity of moles O_2 in the exhaust gas of the flare per kg residual gas flared in hour *h*

$t_{O2,h}$ - Volumetric fraction of O_2 in the exhaust gas in the hour *h*

MF_{O2} - Volumetric fraction of O_2 in the air (0.21)

F_h - kmol/kg - residual gas - Stochiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour *h*

$fm_{j,h}$ - Mass fraction of element *j* in the residual gas in hour *h* (from equation 4)

AM_j - kg/kmol - Atomic mass of element *j*

j - The elements carbon (index C) and nitrogen (index N)

$$F_h = \frac{fm_{C,h}}{AM_C} + \frac{fm_{H,h}}{4AM_H} + \frac{fm_{O,h}}{AM_O}$$

F_h - kmol O_2/kg residual gas - Stoichiometric quantity of moles of O_2 required for a complete oxidation of one kg residual gas in hour *h*

$fm_{j,h}$ - Mass fraction of element *j* in the residual gas in hour *h* (from equation 4)

AM_j - kg/kmol Atomic mass of element *j*

j - The elements carbon (index C), hydrogen (index H) and oxygen (index O)

STEP 4. Determination of methane mass flow rate in the exhaust gas on a dry basis

The mass flow of methane in the exhaust gas is based on the volumetric flow of the exhaust gas and the measured concentration of methane in the exhaust gas, as follows:

$$TM_{FG,h} = \frac{TV_{n,FG,h} * fv_{CH_4,FG,h}}{1000000}$$

$TM_{FG,h}$ - kg/h - Mass flow rate of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour *h*

$TV_{n,FG,h}$ - m3/h exhaust gas - Volumetric flow rate of the exhaust gas in dry basis at normal conditions in hour *h*

$fv_{CH4,FG,h}$ - mg/m3 - Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in hour *h*

STEP 5. Determination of methane mass flow rate in the residual gas on a dry basis

The quantity of methane in the residual gas flowing into the flare is the product of the volumetric flow rate of the residual gas ($FV_{RG,h}$), the volumetric fraction of methane in the residual gas ($fv_{CH4,RG,h}$) and the density of methane ($\rho_{CH4,n,h}$) in the same reference conditions (normal conditions and dry or wet basis).

It is necessary to refer both measurements (flow rate of the residual gas and volumetric fraction of methane in the residual gas) to the same reference condition that may be dry or wet basis. If the residual gas moisture is significant (temperature greater than 60ºC), the measured flow rate of the residual gas that is usually referred to wet basis should be corrected to dry basis due to the fact that the measurement of methane is usually undertaken on a dry basis (i.e. water is removed before sample analysis).

$$TM_{RG,h} = FV_{RG,h} * fv_{CH_4,RG,h} \times \rho_{CH_4,n}$$

$TM_{RG,h}$ - kg/h - Mass flow rate of methane in the residual gas in the hour *h*

$FV_{RG,h}$ - m3/h-Volumetric flow rate of the residual gas in dry basis at normal conditions in hour *h*

$fv_{CH4,RG,h}$ - Volumetric fraction of methane in the residual gas on dry basis in hour *h* (NB: this corresponds to $fv_{i,RG,h}$ where *i* refers to methane).

$\rho_{CH4,n}$ - kg/m3 - Density of methane at normal conditions (0.716)

STEP 6. Determination of the hourly flare efficiency

As the approach selected by the project participants is to use a enclosed flare, and monitor it continuously, the flare efficiency in the hour *h* ($\eta_{flare,h}$) is:

- 0% if the temperature of the exhaust gas of the flare (T_{flare}) is below 500 °C during more than 20 minutes during the hour h.
- determined as follows in cases where the temperature of the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour *h* :

$$\eta_{flare,h} = 1 - \frac{TM_{FG,h}}{TM_{RG,h}}$$

$\eta_{flare,h}$ - Flare efficiency in the hour *h*

$TM_{FG,h}$ - kg/h - Methane mass flow rate in exhaust gas averaged in a period of time t (hour, two months or year)

$TM_{RG,h}$ - kg/h - Mass flow rate of methane in the residual gas in the hour *h*

STEP 7. Calculation of annual project emissions from flaring

Project emissions from flaring are calculated as the sum of emissions from each hour h, based on the methane flow rate in the residual gas ($TM_{RG,h}$) and the flare efficiency during each hour h ($\eta_{flare,h}$), as follows:

$$PE_{flare,y} = \sum_{n=1}^{8760} TM_{RG,h} \times (1 - \eta_{Flare,h}) \times \frac{GWP_{CH_4}}{1000}$$

$PE_{flare,y}$ - Project emissions from Flaring of the residual gas stream in year y (tCO_2e)

$TM_{RG,h}$ - Mass flow rate of the methane in the residual gas in the hour h (kg/h)

$\eta_{Flare,h}$ - Flare efficiency in hour h

GWP_{CH_4} - Global Warming Potential of Methane valid for the commitment period (tCO_2e/tCH_4)

Which is equal to:

$$PE_{flare,y} = TM_{RG,h} \times (1 - FA) \times (1 - \eta_{Flare,h}) \times \frac{GWP_{CH_4}}{1000}$$ (for *ex-ante* calculation)

FA - Flare availability in percentage of operating hours (%) where there is a 90% of flare efficiency.

As the landfill gas will be flared the next equation concludes the estimation of methane destruction:

$$MD_{flared,y} = (LFG_{flared,y} \cdot w_{CH_4} \cdot D_{CH_4}) - (PE_{flare,y} / GWP_{CH_4})$$

$MD_{flared,y}$ = Quantity of methane destroyed by flaring

$LFG_{flared,y}$ = is the quantity of landfill gas flared during the year measured in cubic meters (m^3)

$w_{CH_4,y}$ = 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)

D_{CH_4} = Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4).

From the quantity of methane destroyed ($MD_{flared,y}$), the emission reduction in tCO_2e was obtained using the GWP_{CH4}=21 given by the methodology.

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

There are only 4 parameters that are available at validation that influence actual emission reduction of the project over the first crediting period, which are:

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_2e/tCH_4
Description:	Global Warming Potential of CH_4
Source of data used:	Defined by the methodology
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	The GWP of CH_4 is defined by the ACM0001 methodology as 21 for the first commitment period.
Any comment:	

Data / Parameter:	**AF**
Data unit:	Percentage (%)
Description:	Adjustment Factor to the Baseline
Source of data used:	Estimated
Value applied:	10%
Justification of the choice of data or description of measurement methods and procedures actually applied :	The volume of captured gas is low, since most of the methane is generated in the deeper layers of the landfill, and most of the landfill gas escape(nowadays) through the skirts of the landfill. The gas flux in the top of the upper layers (where the decomposition is mostly aerobic) is so low that flaring not always possible, verifying mostly the ventilation. The existing contractual documents do not determine capturing or flaring the gas. On the landfill there is an implemented venting system that does not, adequately, support the burning of the LFG. The flow on burning drains has been measured and estimated that would be burned about 2,63% of the expected landfill gas on 2008 descending to about 2,27% on 2014.

	So, it is reasonable to assume that a very low volume of gas will be flared, and a 10% EF is considered to be conservative.
Any comment:	

Data / Parameter:	Regulatory requirements relating to landfill gas projects
Data unit:	Text
Description:	Regulatory requirements relating to landfill gas projects
Source of data used:	Laws
Value applied:	There are no regulatory requirements
Justification of the choice of data or description of measurement methods and procedures actually applied :	➢ The Regulatory requirements for landfills will be assessed yearly. ➢ All the data will be recorded yearly, on an electronic database. The responsible person/entity will be defined on the project verification.
Any comment:	

B.6.3 *Ex-ante* calculation of emission reductions:

The ACM0001 considers that: “No leakage effects need to be accounted for this methodology”

Baseline Emissions

According to ACM0001 for *ex ante* emissions estimate: “Project proponents should provide an ex ante estimate of emissions reductions, by projecting the future GHG emissions of the landfill. In doing so, verifiable methods should be used.” So the *ex ante* estimation of the baseline scenario is base on the verifiable IPCC First Order Decay method.

The equation that expresses the FOD method follows:

$$CH_4(Gg/yr) = \sum_x [(A \cdot k \cdot MSW_T(x) \cdot MSW_F(x) \cdot L_0(x)) \cdot e^{-k(t-x)}]$$

Where
t = year of inventory
x = years for which input data should be added
k = methane generation rate constant (1/yr)
$A = (1 - e^{-k})/k$; normalization factor which corrects the summation
$MSW_T(x)$* = Total municipal waste generated in year x (Gg/yr)
MSWF (x)* = Fraction of MSW disposed at SWDS in year x
L_0 = methane generation potential [MCF(x) . DOC(x) . $DOC_F(x)$. 16/12(Gg CH_4/Gg waste)]
MCF(x) = methane correction factor in year x (fraction)
DOC(x) = degradable organic carbon (DOC) in year x (fraction) (Gg C/Gg waste)
DOC_F = fraction of (DOC) dissimilated
16/12 = Conversion from C to CH_4

* MSW_T and MSW_F factors were replaced by the exact amount of waste disposed on the URBAN landfill.

Where:

- k

The IPCC Guideline suggests the k:

TABLE 3.3
RECOMMENDED DEFAULT METHANE GENERATION RATE (*k*) VALUES UNDER TIER 1

(Derived from *k* values obtained in experimental measurements, calculated by models, or used in greenhouse gas inventories and other studies)

Type of Waste		Climate Zone*							
		Boreal and Temperate (MAT ≤ 20°C)				Tropical[1] (MAT > 20°C)			
		Dry (MAP/PET < 1)		Wet (MAP/PET > 1)		Dry (MAP < 1000 mm)		Moist and Wet (MAP ≥ 1000 mm)	
		Default	Range[2]	Default	Range[2]	Default	Range[2]	Default	Range[2]
Slowly degrading waste	Paper/textiles waste	0.04	0.03[3,5] – 0.05[3,4]	0.06	0.05 – 0.07[3,5]	0.045	0.04 – 0.06	0.07	0.06 – 0.085
	Wood/ straw waste	0.02	0.01[3,4] – 0.03[6,7]	0.03	0.02 – 0.04	0.025	0.02 – 0.04	0.035	0.03 – 0.05
Moderately degrading waste	Other (non – food) organic putrescible/ Garden and park waste	0.05	0.04 – 0.06	0.1	0.06 – 0.1[8]	0.065	0.05 – 0.08	0.17	0.15 – 0.2
Rapidly degrading waste	Food waste/Sewage sludge	0.06	0.05 – 0.08	0.185[4]	0.1[3,4] – 0.2[9]	0.085	0.07 – 0.1	0.4	0.17 – 0.7[10]
Bulk Waste		0.05	0.04 – 0.06	0.09	0.08[8] – 0.1	0.065	0.05 – 0.08	0.17	0.15[11] – 0.2

[1] The available information on the determination of k and half-lives in tropical conditions is quite limited. The values included in the table, for those conditions, are indicative and mostly have been derived from the assumptions described in the text and values obtained for temperate conditions.

[2] The range refers to the minimum and maximum data reported in literature or estimated by the authors of the chapter. It is included, basically, to describe the uncertainty associated with the default value.

[3] Oonk and Boom (1995).

[4] IPCC (2000).

[5] Brown *et al*. (1999). A near value (16 yr) was used, for slow degradability, in the GasSim model verification (Attenborough *et al*., 2002).

[6] Environment Canada (2003).

[7] In this range are reported longer half-lives values (up to 231 years) that were not included in the table since are derived from extremely low *k* values used in sites with mean daily temperature < 0°C (Levelton, 1991).

[8] Estimated from RIVM (2004).

[9] Value used for rapid degradability, in the GasSim model verification (Attenborough *et al*., 2002);

[10] Estimated from Jensen and Pipatti (2003).

[11] Considering t1/2 = 4 - 7 yr as characteristic values for most developing countries in a tropical climate. High moisture conditions and higly degradable waste.

*Adapted from: Chapter 3 in *GPG-LULUCF* (IPCC, 2003).

MAT – Mean annual temperature; MAP – Mean annual precipitation; PET – Potential evapotranspiration.

MAP/PET is the ratio of MAP to PET. The average annual MAT, MAP and PET during the time series should be selected to estimate emissions and indicated by the nearest representative meteorological station.

São José do Campos qualify as tropical having a MAT above 20^{o}C, and a MAP above 1200mm/year, according to “Centro de Pesquisa Meteorológicas e Climáticas Aplicadas a Agricultura da UNICAMP”(Meteorological and Climate Research Centre from Campinas University) and most of the waste is fast degradables the parameter “k” chosen was k=0,1 as a conservative measure.

- L_0 = MCF(x)*DOC(x)*DOC_F* F*16/12

  F = Fraction by volume of CH_4 in landfill gas (default 0,5 - IPCC)

- MCF(x):

TABLE 3.1
SWDS CLASSIFICATION AND METHANE CORRECTION FACTORS (MCF)

Type of Site	Methane Correction Factor (MCF) Default Values
Managed – anaerobic [1]	1.0
Managed – semi-aerobic [2]	0.5
Unmanaged [3] – deep (>5 m waste) and /or high water table	0.8
Unmanaged [4] – shallow (<5 m waste)	0.4
Uncategorised SWDS [5]	0.6

[1] **Anaerobic managed solid waste disposal sites**: These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) levelling of the waste.

[2] **Semi-aerobic managed solid waste disposal sites**: These must have controlled placement of waste and will include all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system.

[3] **Unmanaged solid waste disposal sites – deep and/or with high water table**: All SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 metres and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste.

[4] **Unmanaged shallow solid waste disposal sites**; All SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.

[5] **Uncategorised solid waste disposal sites**: Only if countries cannot categorise their SWDS into above four categories of managed and unmanaged SWDS, the MCF for this category can be used.

Sources: IPCC (2000); Matsufuji *et al.* (1996)

IPCC Guideline

As URBAM landfill is a managed landfill MCF(x) = 1.0.

- DOC(x) :

  DOC = 0.4(A) + 0.17(B) + 0.15(C) + 0.30(D)

  A = Per cent MSW that is paper and textiles
  B = Per cent MSW that is garden waste, park waste or other non-food organic putrescibles
  C = Per cent MSW that is food waste
  D = Per cent MSW that is wood or straw

IPCC Guideline

The percentage of each type of material has been measured and was sent to the DOE, allowing the calculation of the parameter DOC(x).

- DOC_F :

  DOC_F = 0,014*(T) +0.28

  T = landfill temperature in C^o

The Amount of Methane that would have been destroyed/combusted during the year in the absence of the project:

As there are no regulatory or contractual requirements specifying $MD_{reg,y}$ the "Adjustment Factor" shall be used:

$$MD_{reg,y} = MD_{project,y} \cdot AF$$

To URBAM landfill there are, absolutely, no regulations or contract requirements that generate the Methane destruction. On the landfill there is a venting system that do not support the burning of the LFG, since is a concrete drain that do not support the temperature of the flame. Besides the capturing system used on the landfill today is so inefficient that the gas captured is not adequate to be burned. So the Adjustment Factor considered was 10%, as conservative action, since the methane can not be burned nowadays.

Project Emissions

There are no sources of emission which might be attributed to the project activities outside its limits because the project does not export electricity. The project activity will produce all the energy needed for the project activity from landfill gas, and no emission reductions will be claimed for displacing/avoiding emissions from other sources as a conservative measure.

The only emissions will result from the efficiency/availability of the flare and the efficiency of the LFG capturing system:

- Capturing System Efficiency CE = 60% (already considered on the $MD_{project,y}$)

  Since there are losses of gas through the skirts of each layer of the landfill, LFG Capturing System efficiency estimated is 60%. Though, Araúna is appraising the financial viability of covering the skirts of the landfill to undermine those losses.

- FE

  Flare availability (the percentage of the time that the flare is destroying the methane) estimated as (recommended by manufacturer): 96%

Flare Efficiency (the percentage of the methane destroyed by the flare) estimated as (recommended by manufacturer): 90% - Will be monitored and calculated as defined by the "Tool to determine project emissions from flaring gases containing methane", as described on the item B.6.1., during the project activity.

As required by the methodology the next equation concludes the estimation of methane destruction on the flare, only system considered on this Project:

$$MD_{project,y} = MD_{flared,y} = (LFG_{flared,y} \cdot w_{CH_4} \cdot D_{CH_4}) - (PE_{flare,y} / GWP_{CH_4})$$

$MD_{flared,y}$ = Quantity of methane destroyed by flaring

$LFG_{flared,y}$ = Volume o landfill gas flared

$w_{CH_4,y}$ = The average methane fraction of the landfill gas

D_{CH_4} = Methane density

$PE_{flare,y}$ - Project emissions from Flaring of the residual gas stream in year y (tCO_2e)

From the quantity of methane destroyed($MD_{flared,y}$), the emission reduction in tCO_2e was obtained using the GWP_{CH4}=21 given by the methodology.

Project Parameters	
Year when operation started	1987
Year when flaring will start	2008
Lo(Gg CH4/ Gg of residue)	0,0986
k(1/year)	0,1
GWP(CH4)	21
w (% of methane in LFG)	50%
Gas capture efficiency	60%
Flare efficiency (for *ex-ante* calculation)	90%
Flare Availability (for *ex-ante* calculation)	96%
AF	10%
Total waste from 1987 to 2014 (tons)	3.777.836

Conclusion of *Ex-ante* calculation :

$$ER_Y = (MD_{project,y} - MD_{reg,y}) \cdot GWP_{CH4} + EL_y \cdot CEF_{electricitry} - ET_y \cdot CEF_{termal}$$

ER_Y - Emission reduction in a given year "y", in tonnes of CO_2 equivalent (tCO_2e);

$MD_{project,y}$ - The amount of methane that would have been destroyed/combusted by the project activity during the year, in tonnes 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, tonnes 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);

$CEF_{electricitry}$ - CO_2 emissions intensity of the electricity displaced, in tCO_2e/MWh. Since all the electricity used by the project will be produced by landfill gas the grid electricity emission is not relevant for the UALGP.;

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_{termal} - CO_2 emissions intensity of the fuel used to generate thermal/mechanical energy, in tCO_2e/TJ.

For the 7 years:

$MD_{project} = 990.117$ tCO_2e

$MD_{reg} = 98.963$ tCO_2e

$GWP_{CH_4} = 21$

$EL = EL_{IMP} = 0$

$ET_y = 0$

So the estimated *ex-ante* Emission Reductions are $ER_{7\,years} =$

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emission reductions shall be in using the following tabular format	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2008	107.946
2009	111.195
2010	114.271
2011	117.190

2012	119.970
2013	122.624
2014	125.167
Total estimated reductions (tonnes of CO_2e)	**818.362**
Total number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**116.909**

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

Estimation of project activity emissions (tonnes of CO_2e) – Includes:

- 40% inefficiency on the landfill gas capturing system;
- 10% inefficiency of the enclosed flare;
- 4% unavailability of the flaring system and

Estimation of baseline emissions (tonnes of CO_2e) – Includes:

- 90% of the total emission estimated through the FOD method(detailed on B.6.3 item) due to AF(10%).

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)
2008	111.425	219.371	-	107.946
2009	114.780	225.975	-	111.195
2010	117.954	232.225	-	114.271
2011	120.968	238.158	-	117.190
2012	123.837	243.807	-	119.970
2013	126.577	249.201	-	122.624
2014	129.201	254.368	-	125.167
Total (tonnes of CO_2e)	844.743	1.663.105	-	818.362

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**1.$LFG_{total,y}$ - $FV_{RG,h}$**
Data unit:	m3(cubic meters)
Description:	Total amount of landfill gas captured and flared
Source of data to be used:	Flow meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	139.830.506 m^3 of landfill gas sent to the flare between 2008 and 2014
Description of measurement methods and procedures to be applied:	➢ The flow of landfill gas will be measured right before the flare, avoiding the measurement of landfill gas that might leak. ➢ There is a Low level of uncertainty on this type of equipment which is quite common on the industry and quite accurate. Even so, the flow meter will be calibrated once a year. ➢ All the data will be recorded continuously, on an electronic database. ➢ The responsible person/entity will be defined on the project verification.
QA/QC procedures to be applied:	Flow meters will be subjected to a regular maintenance and testing regime to ensure accuracy.
Any comment:	As there is no other system that uses landfill gas that will claim CERs, such as boiler or generator, the only flow meter will be the one on the flare system. The data will be kept during the crediting period and two years after.

Data / Parameter:	**6.$W_{CH4,y}$**
Data unit:	% (Percentage) - m^3 CH_4/ m^3 LFG
Description:	Methane fraction in the landfill gas
Source of data to be used:	LFG analysis
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:	➢ The Methane fraction on the LFG gas will be measured continuously. ➢ There is a Low level of uncertainty on this type of equipment. Even so, the gas analyzer will be calibrated once a year. ➢ All the data will be recorded continuously, on an electronic database. ➢ The responsible person/entity will be defined on the project verification.
QA/QC procedures to be applied:	Gas Analyzer will be subjected to a regular maintenance and testing regime to ensure accuracy.
Any comment:	The data will be kept during the crediting period and two years after.

Data / Parameter:	**7.$T_{Landfill\ gas}$**

Data unit:	^{o}C (Celsius)
Description:	Temperature
Source of data to be used:	Thermometers
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Standard temperature and pressure - 0 ^{c}C
Description of measurement methods and procedures to be applied:	➢ The Temperature of the LFG gas will be measured continuously. ➢ There is a Low level of uncertainty on this type of equipment. Even so, the thermometer will be calibrated once a year. ➢ All the data will be recorded continuously, on an electronic database. ➢ The responsible person/entity will be defined on the project verification.
QA/QC procedures to be applied:	Thermocouples will be replaced or calibrated every year
Any comment:	Measured to determine the density of methane D_{CH4}. No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters. The data will be kept during the crediting period and two years after.

Data / Parameter:	**8.P**
Data unit:	Pa (Pascal)
Description:	Pressure of the landfill gas
Source of data to be used:	Manometer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Standard temperature and pressure - 1,013 bar
Description of measurement methods and procedures to be applied:	➢ The Pressure of the LFG gas will be measured continuously. ➢ There is a Low level of uncertainty on this type of equipment. Even so, the manometer will be calibrated once a year. ➢ All the data will be recorded continuously, on an electronic database. ➢ The responsible person/entity will be defined on the project verification.
QA/QC procedures to be applied:	Manometer will be subjected to a regular maintenance and testing regime to ensure accuracy.
Any comment:	Measured to determine the density of methane D_{CH4}. No separate monitoring of pressure is necessary when using flow meters that automatically measure temperature and pressure, expressing LFG volumes in normalized cubic meters. The data will be kept during the crediting period and two years after.

Data / Parameter:	**13.Regulatory requirements relating to landfill gas projects**
Data unit:	Text
Description:	Regulatory requirements relating to landfill gas projects
Source of data to be used:	Laws
Value of data applied for the purpose of calculating expected emission reductions in section B.5	There are no regulatory requirements
Description of measurement methods and procedures to be applied:	➢ The Regulatory requirements for landfills will be assessed yearly. ➢ All the data will be recorded yearly, on an electronic database. ➢ The responsible person/entity will be defined on the project verification.
QA/QC procedures to be applied:	Regulatory requirements will be revised yearly by the project participants.
Any comment:	The information though recorded annually, is used for changes to the adjustment factor (AF) or directly MDreg,y at renewal of the credit period. The data will be kept during the crediting period and two years after.

The ACM0001 parameter 5. $PE_{flare,y}$ (Project Emissions flaring the residual gas stream in the year y) need to be calculated from the following parameters that will be monitored, , according to "Tool to determine project emissions from flaring gases containing methane"

Data / Parameter:	**5. $PE_{flare,y}$**
Data unit:	tCO_2e
Description:	Emissions flaring the residual gas stream in the year y
Source of data to be used:	Calculated according to "Tool to determine project emissions from flaring gases containing methane" – The flare efficiency will be continuously monitored.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For *ex ante* calculation was considered the default value 90% defined by the "Tool to determine project emissions from flaring gases containing methane".
Description of measurement methods and procedures to be applied:	The following parameter will be monitored, so $PE_{flare,y}$ can be calculated according to "Tool to determine project emissions from flaring gases containing methane".
QA/QC procedures to be applied:	See parameters $FV_{i,h}$, $t_{O2,h}$, $fv_{CH4,FG,h}$ and T_{flare}.
.Any comment:	As a simplified approach, project participants will only measure the methane content of the residual gas and consider the remaining part as N_2. The data will be kept during the crediting period and two years after.

Data / Parameter:	**$FVf_{i,h}$**
Data unit:	-

Description:	Volumetric fraction of component *I* in the residual gas in the hour *h* where *i*= CO_2, CO, O_2, H_2, N_2 and CH_4 (already considered as $\mathbf{W_{CH4,y}}$, above)
Source of data to be used:	Measurements by project participants using a continuous gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This factor was not considered on the *ex-ante* estimation.
Description of measurement methods and procedures to be applied:	Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 ºC Frequency: Continuously. Values to be averaged hourly or at a shorter time interval
QA/QC procedures to be applied:	Analyzers must be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Any comment:	As a simplified approach, project participants will only measure the methane content of the residual gas and consider the remaining part as N_2.

Data / Parameter:	$t_{O2,h}$
Data unit:	-
Description:	Volumetric fraction of O2 in the exhaust gas of the flare in the hour h
Source of data to be used:	Measurements by project participants using a continuous gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This factor was not considered on the *ex-ante* estimation.
Description of measurement methods and procedures to be applied:	Extractive sampling analyzers with water and particulates removal devices or in situ analyzers for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). Frequency: Continuously. Values will be averaged hourly or at a shorter time interval.
QA/QC procedures to be applied:	Analyzers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard gas.
Any comment:	

Data / Parameter:	$fv_{CH4,FG,h}$
Data unit:	mg/m3
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:	Measurements by project participants using a continuous gas analyzer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This factor was not considered on the ex-ante estimation.
Description of measurement methods and procedures to be applied:	Extractive sampling analyzers with water and particulates removal devices or in situ analyzer for wet basis determination. The point of measurement (sampling point) shall be in the upper section of the flare (80% of total flare height). Sampling shall be conducted with appropriate sampling probes adequate to high temperatures level (e.g. inconel probes). Frequency: Continuously. Values will be averaged hourly or at a shorter time interval.
QA/QC procedures to be applied:	Analyzers will be periodically calibrated according to manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard gas.
Any comment:	Measurement instruments may read ppmv or % values. To convert from ppmv to mg/m3 simply multiply by 0.716. 1% equals 10 000 ppmv.

Data / Parameter:	$\mathbf{T_{flare}}$
Data unit:	^{o}C
Description:	Temperature on the exhaust gas of the flare
Source of data to be used:	Measurements by project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	This factor was not considered on the *ex-ante* estimation.
Description of measurement methods and procedures to be applied:	Measure the temperature of the exhaust gas stream in the flare by a Type N thermocouple. A temperature above 500 ^{o}C indicates that a significant amount of gases are still being burnt and that the flare is operating.
QA/QC procedures to be applied:	Thermocouples will be replaced or calibrated every year
Any comment:	

B.7.2 Description of the monitoring plan:

The responsible entity for the monitoring system is Araúna Participações e Investimentos Ltda. Project Participant.

As all the energy to support the project activity will be generated on landfill gas engines, but no emissions reductions will be claimed from displace energy from other sources, in case of unwanted emissions due to forced utilization of grid electricity an *ex post* emission factor will be calculated according to ACM0002 version 06.

The Project will start on 01/07/2007 and the crediting period is predicted to start on 01/07/2008 so no technical documentation on monitoring and maintenance plan has be developed at this time.

However the actions of quality guarantee that will be implemented in the context of the UALGP are the following:

Maintenance Plan: The following aspects are the focus on the maintenance of the monitoring system in order to assure the data monitoring during the project:

- Equipment preventive maintenance;
- Spare Parts to avoid unwanted stops;
- Equipment calibration, according to item B.7.1 and the date of validity of documentation of calibration.

Register of Field Monitoring: The monitoring of the variables of the process indicated on B.7.1 item will be carried out electronically on a fully automated system* in order to ensure the follow up of its behaviour in time, allowing the verification of any anomalies in the process and the beginning of correctional and/or preventive actions in due time to eliminate its causes.

Backup: All the monitoring data will be backed up on a daily basis to 2 different sites from landfill site itself to ensure a minimum loss of data.

*A fully automated system is planed for this project, however as it is a very initial phase there might be barriers to implement such a system, not foreseen at this point.

Calibration of the measurement equipment: The calibration of the measurement equipment and/or monitoring will be done periodically, considering the date of validity of an official calibration document from, whenever applicable, a qualified companies/entities.

Periodical Inspection: Inspections will be carried out by the responsible ones in the involved technical team, related to the: accompaniment of the operation; inspection of the equipment and analysis of the data collected and indexes of maintenance and regularity of the functioning of the equipment.

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)

Date of completion of this section of the baseline and Monitoring

- 15/12/2006

Name of the person/entity that determines the baseline

- Green Domus Desenvolvimento Sustentável Ltda.
  Rua Nova Orleans, 297 – Brooklin Novo – São Paulo, SP – Brazil – CEP 04561-030
  Responsible: André Leonel Leal
  e-mail: andrell@greendomus.com.br

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:

- 01/07/2007

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

- 21 years and 0 months

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:

- 01/07/2008

C.2.1.2. Length of the first crediting period:

- 7 years and 0 months

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

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

The URBAM landfill operation and installations are in fully accordance with Sao Paulo state legislation referent. See following licenses

Licenses list:

- Installation License
  # 03000067 – Process # 03/00127/99 – Date 23/08/2005 (dd/mm/yyyy).

- Working License

3000979 – Process # 03/001279/99 – Date 29/08/2002 (dd/mm/yyyy).

- Operation License
  # 3001706 – Process # 03/00558/95 – Date 31/08/2005 (dd/mm/yyyy).

Therefore environmental impacts which are landfill responsibility are in compliance with regulatory requirements to sanitary landfill respecting environmental requirements within the proper law.

The burning system considered on this project allows GHG emissions reduction. Beside the methane, considered by UALGP, there are others gases, which are not quantified on this document, such as sulphur dioxide and volatile organic compounds which will be burned as well. The result will be emission reduction of other harm emissions besides the methane.

The LFG capture and flaring reduce the risks of explosion due to spontaneous combustion on the landfill. This can be classified as a risk mitigation of a negative environment impact as it reduces this event probability.

Also, LFG flaring reduce, in a significant way, the impact of odors which are especially relevant for landfill neighbourhoods.

Reducing GHG emissions, explosion risks and odors are positive environmental impacts which are added to social and economic factor, also present on this project, contributes to sustainable development.

The environment license for the project will be obtained after the construction of the capturing and flaring systems.

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:

From all environmental impacts evaluated, no negative impacts were considered relevant.

SECTION E. Stakeholders' comments

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

According to the Resolution 1 of Brazilians DNA "Comissão Interministerial de Mudança Global do Clima", issued in December 2nd 2003, the decree from July 7th 1999, invitations to comment on the project will be sent to entities listed in Article 3 item II on the referred resolution and, additionally, to other entities to which the subject could interest, allowing commenting on the project. Follows the list of entities invited to comment:

1. **Prefeitura Municipal de São José dos Campos (São José dos Campos Mayor)**

   - Paço Municipal - 7º andar
     End.: Rua José de Alencar, 123 - Vila Santa Luzia
     São José Dos Campos - SP

12.209-530

2. **Secretaria Municipal de Desenvolvimento Social (County Social Development Secretary)**

    - End.: Paço Municipal - 5º andar
      Rua José de Alencar, 123 - Vila Santa Luzia
      São José Dos Campos - SP
      12.209-530

3. **Câmara Municipal do Município de São José dos Campos (São José dos Campos Municipality)**

    - End.: Rua Desembargador Francisco Murilo Pinto, 33 - Vila Sta. Luzia
      São José Dos Campos - SP.
      12209-530

4. **Secretaria Municipal do Meio Ambiente (County Environment Secretary)**

    - End.:Av. Olivo Gomes, 100 – Casa do Café – Pq. Da Cidade
      São José Dos Campos - SP
      12.211-420

5. **Secretaria Estadual de Meio Ambiente (State Environment Secretary)**

    - End.: Av. Prof. Frederico Hermann Jr., 345
      São Paulo – SP
      05459-900

    Companhia de Tecnologia de Saneamento Ambiental - CETESB (Environmental agency)
    - End.: Av. Prof. Frederico Hermann Jr., 345
      São Paulo – SP
      05459-900

6. **Fórum Brasileiro de ONGs (NGO Brazilian Forun)**

    - End.: SCLN 210 – Bloco C – Sala 102
      Brasília – DF
      70856-530

7. **Ministério Público de São Jose dos Campos (São José dos Campos public prosecution)**

    - End.: Praça Melvin Jones, 22 – Jd. São Dimas
      São José Dos Campos - SP
      12245-360

8. **Entidades Ambientais (Environmental Entities)**

    - **CAMIN – Centro de Amigos da Natureza**
      End.: Rua Assis, 63 – Jardim Apolo

São José Dos Campos - SP
12243-170

- **Associação Vale Verde**
  End.: Av. Francisco José Longo , 149 – sala 57 - Vila Adyana
  São José Dos Campos - SP
  12245-900

- **Instituto Ecosolidário**
  End.: Rua Euclides Miragaia, 145 – Centro
  São José Dos Campos - SP
  12245-550

- **Grupo Consciência Ecológica**
  End.: Rua Dolzani Ricardo, 215 - Centro
  São José Dos Campos - SP
  12210-110

- **Ecosistema**
  End.: Alameda C. Weeks, 14 loja 2 - Edifício New Center Vista Verde
  São José Dos Campos - SP

- **Instituto Cidadão Natureza**
  End.: Rua Jorge Barbosa Moreira, 215 – apto 11 – Vila Ema
  São José dos Campos – SP
  12243-070

Registered Letters were sent on December of 2006. Responses shall be received before the end of February 2007 and will be considered on E.2 summary.

E.2. Summary of the comments received:

No comments were received at this point of the project

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

No comments were received at this point of the project

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	URBAM – Urbanizadora Municipal S/A
Street/P.O.Box:	Rua Ricardo Edwards, 100 – Vila Industrial
Building:	
City:	São José dos Campos
State/Region:	São Paulo
Postfix/ZIP:	12.220-290
Country:	Brazil
Telephone:	55 12 3908-6004
FAX:	55 11 3908-6051
E-Mail:	presidencia@urban.com.br
URL:	
Represented by:	Felício Ramuth
Title:	President
Salutation:	Mr.
Last Name:	Ramuth
Middle Name:	-
First Name:	Felício
Department:	
Mobile:	
Direct FAX:	55 12 3908-6051
Direct tel:	55 12 3908- 6004
Personal E-Mail:	presidencia@urban.com.br

Organization:	Araúna Participações e Investimentos Ltda
Street/P.O.Box:	Al. Jaú, 1742 - cj. 11
Building:	Edifício Armando Petrella
City:	São Paulo
State/Region:	São Paulo
Postfix/ZIP:	01420-002
Country:	Brazil
Telephone:	55 11 3894 33 11
FAX:	55 11 3849 33 11
E-Mail:	grupoarauna@grupoarauna.com.br
URL:	www.grupoarauna.com.br
Represented by:	
Title:	Director
Salutation:	Mr.
Last Name:	Maruca
Middle Name:	Roberto
First Name:	Mauricio
Department:	Board of Directors

Mobile:	
Direct FAX:	55 11 3894 33 11
Direct tel:	55 11 3894 33 11
Personal E-Mail:	maruca@grupoarauna.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There are no public financing for the project.

Annex 3

BASELINE INFORMATION

Project Parameters	
Year when operation started	1987
Year when flaring started	2008
Lo(Gg CH4/ Gg of residue)	0,0986
k(1/year)	0,1
GWP(CH4)	21
w (% of methane in LFG)	50%
Gas capture efficiency	60%
Flare efficiency	90%
Flare Availability	96%
EAF	10%
Total waste from 1987 to 2014 (tons)	3.777.836

	Estimated Emissions without the project activity				Estimated Total Project Emission			Estimated Project Emission Reduction
	Total Estimated emissions		AF 10%	Estimated emissions abating AF	LFG capture Inefficiency	Flare Inefficieny (2%)	Flare Unavailability (4%)	
Year	tCH_4	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e	tCO_2e
1st	11.017	231.365	11.994	219.371	92.546	13.882	4.997	107.946
2nd	11.349	238.330	12.355	225.975	95.332	14.300	5.148	111.195
3rd	11.663	244.922	12.697	232.225	97.969	14.695	5.290	114.271
4th	11.961	251.179	13.021	238.158	100.472	15.071	5.425	117.190
5th	12.245	257.137	13.330	243.807	102.855	15.428	5.554	119.970
6th	12.516	262.826	13.625	249.201	105.130	15.770	5.677	122.624
7th	12.775	268.275	13.907	254.368	107.310	16.097	5.795	125.167
Total in 7 years	83.525	1.754.034	90.929	1.663.105	701.614	105.242	37.887	818.362
Annual average	11.932	250.576	12.990	237.586	100.231	15.035	5.412	116.909

Operating License

GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DO MEIO AMBIENTE
CETESB - COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

02 | Processo Nº 03/00558/05

Nº 3001706

Data 31/08/2005

LICENÇA DE OPERAÇÃO
VALIDADE ATÉ : 31/08/2010

RENOVACÃO

IDENTIFICAÇÃO DA ENTIDADE

Nome: URBANIZADORA MUNICIPAL S/A URBAM
CNPJ: 45.693.777/0002-06
Cadastro na CETESB: 645 - 00549 - 0
Logradouro: ESTRADA DO TORRÃO DE OURO S/Nº
Número: 0 | Complemento: | Bairro: TORRÃO DE OURO | CEP: 12231-790 | Município: SÃO JOSÉ DOS CAMPOS

CARACTERÍSTICAS DO PROJETO

Atividade Principal
Descrição: Aterro sanitário | Código: 9000-0/02

Bacia Hidrográfica: 61 - PARAÍBA | UGRHI: 2 - PARAÍBA DO SUL
Corpo Receptor: | Classe:

Área (metro quadrado)

Terreno	Construída	Atividade ao Ar Livre	Novos Equipamentos	Lavra(ha)
320000,00	3800,00	278487,00		

Horário de Funcionamento (h): Início 06:30 às Término 05:30

Número de Funcionários: Administração 14 | Produção 219

Licença de Instalação: Data / / | Número

A CETESB-Companhia de Tecnologia de Saneamento Ambiental, no uso das atribuições que lhe foram conferidas pela Lei Estadual nº 997, de 31 de maio de 1976, regulamentada pelo Decreto nº 8468, de 8 de setembro de 1976, e suas alterações, concede a presente licença, nas condições e termos nela constantes;

A presente licença está sendo concedida com base nas informações apresentadas pelo interessado e não dispensa nem substitui quaisquer Alvarás ou Certidões de qualquer natureza, exigidos pela legislação federal, estadual ou municipal;

A presente Licença de Operação refere-se aos locais, equipamentos ou processos produtivos relacionados em folha anexa;

Os equipamentos de controle de poluição existentes deverão ser mantidos e operados adequadamente, de modo a conservar sua eficiência;

No caso de exigência de equipamentos ou dispositivos de queima de combustível, a densidade da fumaça emitida pelos mesmos deverá estar de acordo com o disposto no artigo 31 do Regulamento da Lei Estadual nº 997, de 31 de maio de 1976, aprovado pelo Decreto nº 8468, de 8 de setembro de 1976, e suas alterações;

Alterações nas atuais atividades, processos ou equipamentos deverão ser precedidas de Licença Prévia e Licença de Instalação, nos termos dos artigos 58 e 58-A do Regulamento acima mencionado;

Caso venham a existir reclamações da população vizinha em relação a problemas de poluição ambiental causados pela firma, esta deverá tomar medidas no sentido de solucioná-los em caráter de urgência;

A renovação da licença de operação deverá ser requerida com antecedência mínima de 120 dias, contados da data da expiração de seu prazo de validade.

USO DA CETESB
SD Nº 03005691

EMITENTE
Local: Agência Ambiental de Taubaté

Selo de Autenticidade — CETESB Companhia de Tecnologia de Saneamento Ambiental

Pag. 1

ENTIDADE

Eng.º Mário Luiz Alves
Gerente da Agência Ambiental de Taubaté
CREA 502.552/D - Reg. 03-1643-4

Annex 4

MONITORING INFORMATION

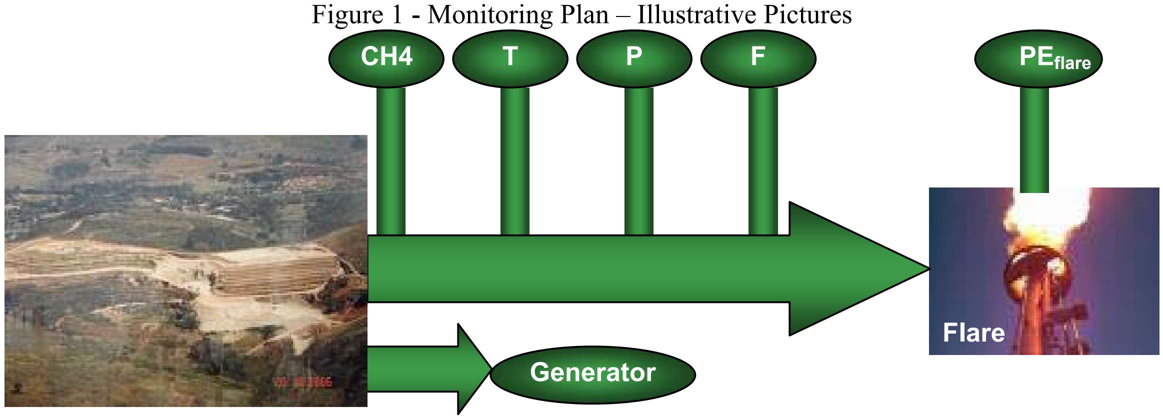
Monitoring Methodology

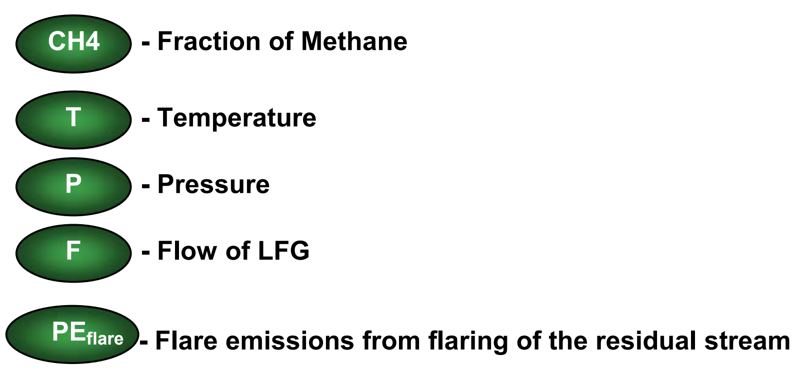
The monitoring methodology is based on direct measurement of the amount of landfill gas captured and destroyed at the flare platform to determine the quantities as shown in Figure 1. The monitoring plan provides for continuous measurement of the quantity and quality of LFG flared. The main variables that need to be determined are the quantity of methane actually captured $MD_{project,y}$, quantity of methane flared ($MD_{flared,y}$).

The UALGP will only produce electricity for utilization on the landfill and not request the emission reductions due grid electricity displacement. The landfill gas monitoring system will be placed physically after the generator, avoiding any inappropriate measurement of the landfill gas.

All the energy to support the project activity will be generated on landfill gas engines, in case of unwanted emissions due to forced utilization of grid electricity an *ex post* emission factor will be calculated according to ACM0002 version 06.

Figure 1 - Monitoring Plan – Illustrative Pictures





To determine these variables, the following parameters have to be monitored:

- ***$LFG_{total,y}$*** - The amount of landfill gas generated (in m³, using a continuous flow meter), where the total quantity (*$LFG_{total,y}$*) is the quantities fed to the flare (*$LFG_{flare,y}$*) and will be measured continuously. All the flow data will be electronically collected and stored, backup will be done on a daily basis;

- ***$w_{CH4,y}$*** - The fraction of methane in the landfill gas (*$w_{CH4,y}$*) will be measured with a continuous analyzer. All the fraction of methane will be electronically collected and stored, backup will be done on a daily basis;

- The parameters used for determining the project emissions from flaring of the residual gas stream in year y ($PE_{flare,y}$) will be monitored as per the "Tool to determine project emissions from flaring gases containing Methane". Some of the parameter might not be monitored on a fully automated system, such as methane and oxygen measurements on the exhaust of the flare, however the data will be manually imputed on an electronic report;

    - $Fv_{i,h}$ - Volumetric fraction of component *I* in the residual gas in the hour *h* where *i*= CO_2, CO, O_2, H_2, N_2 and CH_4 (already considered as $W_{CH4,y}$, above – as a simplified aproach the CH_4 will be measured and the remaining part will be considered N_2);

    - $t_{O2,h}$ - Volumetric fraction of O_2 in the exhaust gas of the flare in the hour h, continuous measurements will be made, if economically viable, electronic collection and storage system will be used, backup will be done on daily basis;

    - $fv_{CH4,FG,h}$ - Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h, continuous measurements will be made, if economically viable, electronic collection and storage system will be used, backup will be done on daily basis;

    - T_{flare} – Temperature on the exhaust of the flare will be electronically collected and stored, backup will be done on a daily basis;

- Temperature (*T*) and pressure (*p*) of the landfill gas will be electronically collected and stored, backup will be done on a daily basis;

- Relevant regulations for LFG project activities will be monitored annually and considered at renewal of each crediting period. Changes to regulation will be converted to the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity (*$MD_{reg,y}$*). Project participants will explain how regulations are translated into that amount of gas.

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