CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Anaconda Landfill Gas Project.

A.2. Description of the project activity:

Anaconda Ambiental is a company specialized in the management of sanitary landfills. The Anaconda Sanitary Landfill, located in Santa Isabel next to São Paulo city, embraces a total area of 42 alqueires (101,64 hectares) from which 20 (41,67% of the total area) are used for garbage dump. The area is rich in clay deposits, which provided an excellent material for the waterproofing of the landfill bottom, 6-meter thick and with a 98% Normal Proctor compaction and for the intermediate layers in the cell execution, with a 1-meter compact thickness. The landfill receives about 419 tons of garbage daily, having contracts with several city halls nearby and also with countless industries for the reception of the class 2 and 3 residue. The landfill operations began in 2000 and the durability of the site is forecasted to last until the year 2030. In the last 5 years, Anaconda Ambiental was ranked among the best companies of the country in the segment of solid residue, certified by CETESB with a 9.8 classification. The landfill permanently monitors the water tables through wells built in the perimeter, whose depths vary between 16 and 205 meters, positioned near the embouchure and the wellhead of the area.

A.2.1. Project Activity Objective:
Currently Anaconda Ambiental only burns passively a small portion of the gas generated by the landfill through 78 vertical drains which release the vapor in the atmosphere. The objective of the Anaconda Project is to proceed the flaring of the Greenhouse effect gases generated in the context of the Anaconda Sanitary Landfill, based on the Clean Development Mechanism. The implementation of the project forecasts the interconnection of the vertical drains through aerial horizontal tubing and the connection of those to the gas suction and flaring equipment. This will require an investment in the system for gas capture for incineration, which will reduce the emission of CH_4 in the next 7 years in 38 600 tons. Technical analyses have been conducted with the purpose of quantifying the potential volume of the emissions that the project might generate. These analyses were conducted based on equivalent carbon emission projections, both in the project scenario and its baseline. It was observed that the project is capable of generating 812 374 tons of CO_2 credits within its 7-year life span.

The project activity involves the installation of equipment to improve the capture process and the methane flaring, with the initial capacity of 1 479 m3/h in the beginning of the operations in 2 006, expanding to 2 291 m3/h until 2 012, which represents an increase of about 55% in the gas flaring.. The project also aims at optimizing the garbage decomposition to heighten the efficiency of the methane flaring; this will also contribute to increase the landfill life span. The project foresees the donation of 2% of the value raised with the selling of the emission reduction units for activities which will benefit the local community, the environment and the economy, as part of the social responsibility of the company.

A.2.2. Opinion of participants of the project about the contribution of the activity for the sustainable development:
The release of landfill gas without control brings negative impacts to the quality of the environment and to the health of the local inhabitants, besides increasing risks for explosions in the surrounding area; therefore the main impacts of this project will necessarily have a positive effect on the health and the environmental alleviation of the area and its outskirts.

The project will also have a small but positive impact in the number of job offers in the local area due to the number of people who will necessary be recruited to manage the operations of the landfill gas.

A.3. Project participants:

A.3.1. Part(s) and private and/or public entity (ties) involved in the project activity (inform data for contact in Annex 1):

- Anaconda Ambiental Empreendimentos Ltda.
- Araúna Participações e Investimentos Ltda.

A.3.2. The Certified Emission Reduction (CER's) obtained will be divided by the hiring parties in the following proportion:

- Anaconda: 65% (sixty-five per cent)
- Araúna: 35% (thirty-five per cent)

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

- Anaconda Ambiental Sanitary Landfill.

A.4.1.1. Host Party(ies):

- Brazil.

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

- São Paulo, Southeast region.

A.4.1.3. City/Town/Community etc:

- Santa Isabel.

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

- Estrada Velha de Santa Isabel Mogi km 3 - Bairro Cachoeira - Santa Isabel - CEP 07500-000 – SP.

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

- Waste handling and disposal.

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 tubing which is connected to the suction and flaring equipment. All materials and equipment are made in Brazil.

The cutting-edge technology for gas capture includes:

- Landfill cells covered with a compacted clay layer about one meter thick;
- Residue of water canalized and treated at an used water treatment plant;
- Vertical drains used to extract gas;
- Spacing between drains adequate for maximum gas collection, which minimizes costs;
- Gas bonnet projected as a looping system to allow that, in case of partial or total loss of bonnet function in one direction, the functionality of the gas system is not lost, and;
- Extraction and condensed storage system designed in low strategic points through the gas system.

Companies that design and build flares usually operate in wider markets such as combustion, landfill technology or environmental engineering. This is because the overall demand for flares is not sufficient to drive the formation of a dedicated biogas flares industry. However there are a number of companies which manufacture many units per annum and who operate both national and internationally. There are also many smaller light engineering companies in Brazil which produce more basic flares but who do not have the same grounding in combustion or environmental engineering.

The technology for the collected landfill gas flaring includes:

- Elevated Biogas flare type for continuous running;
- Continuous and automated pilot, using GLP/Biogas;
- Ignition and control panel with CLP;
- Hydraulic seal in the base;
- Flaring monitored by flow through thermal-pairs which will measure the gas speed through temperature difference in the passage;
- Gas filtering and drying system through decanting or separation.

The company responsible for the providing the flares should also provide all the documents for the approval and final filing, in digital media solely, including drawings for the approval an for final filing and Operation and Maintenance Manual. A list of these documents will be prepared in due time. Furthermore, the company will also assist the pre-commissioning, training of operators and start, and will provide technical assistance and consulting, including all the specialized engineering services and related to the Biogas System as flowchart elaboration, data sheets, specifications, reports, manuals or other services eventually required and not included among the items above.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

According to the National Inventory of Greenhouse Effect Gas Emission conducted by CETESB in 1994, Brazil has more than 6 000 garbage dumping sites that receive more than 60 000 tons of garbage a day (note that this study is being updated now. According to the same study, 84% of methane emissions in Brazil come from garbage dumping in dumping sites without control. Currently, 76% of the total garbage amount produced in Brazil is disposed in "dumping sites" without administration, gas capture or water treatment. The 24% of the remaining garbage are dumped in "controlled" landfill (and not in "sanitary" landfills, as planned by the project) and apt to regulations of the environmental authorities.

The current Brazilian legislation does not require landfill to capture and disposing of landfill gas and no landfill operating in Brazil was planned to capture and use (or even incinerate) the amount of total gas generated, although there are some places being planned. In some cases where the gases are captured this is done by safety reasons (to prevent explosions) and it is frequent the case when the amounts effectively captured are very low, due to the high levels of chorume (which is usually drained or treated) that block the drain tubes.

The implementation of the environmental protection legislation in Brazil has been quite long and the Environment Ministry does not have immediate plans to introduce the legislation that requires the capture and incineration of landfill gas from the landfill sites. Historically, there is in Brazil a tendency to a gap between the state regulations and the actions related to the implementation of the environment protection legislation. This project is based on the capture and flaring of the landfill gas, converting thus, its methane content into CO_2, reducing its Greenhouse gas effect. The situation at the referred scene is the absence of LFG controlled flaring, and the presence of simple ventilation.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

The period of credit chosen is 7 years, with the possibility of renewal twice. In the table below it is shown the emissions reductions for the first period of credit.

year	ton/year Reduction Emission
2.006	89.469
2.007	99.825
2.008	109.196
2.009	117.675
2.010	125.347
2.011	132.289
2.012	138.571
TOTAL	**812.374**

A.4.5. Public funding of the project activity:

There are no public financing for the project activity.

SECTION B. Application of a baseline methodology

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

Approved consolidated baseline methodology ACM0001:
“Consolidated baseline methodology for landfill gas project activities”

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The approved methodology was developed for cases such as the Anaconda Ambiental Sanitary Landfill, from now on referred to as Anaconda Landfill in this work, in which the baseline scenario is the total or partial release of gases in the atmosphere and whose project activity foresees only the capture and flaring of the generated gas.

The applicability requirements of this methodology are as follows:

- The greenhouse gas emission reduction achieved by the project activity during a given year "y" is the difference between the amount of methane actually destroyed/combusted during the year and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity, times the approved Global Warming Potential value for methane, plus the net quantity of electricity displaced during the year multiplied by the CO_2 emissions intensity of the electricity displaced, plus the quantity of thermal energy displaced during the year multiplied by the CO_2 emissions intensity of the thermal energy displaced. Electricity and thermal energy emission reductions apply only to case in wich 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.
- The methane destroyed by the project activity during a year is determined by monitoring the quantity of methane actually flared and gas used to generate electricity and/or produce thermal energy, if applicable.
- The project boundary is the site of the project activity where the gas is captured and destroyed/used.
- The baseline is the atmospheric release of the gas and 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. The baseline was established from current and historical existing emissions.
- No leakage effects need to be accounted under this methodology.

This baseline methodology shall be used in conjunction with the approved monitoring methodology
ACM0001 ("Consolidated monitoring methodology for landfill gas project activities").

B.2. Description of how the methodology is applied in the context of the project activity:

The baseline draws a scenario in which the future anthropogenic emissions per source are projected above the current levels. The baseline was defined so that the CERs will not be obtained from the decreasing in the levels of activities other than the project activity or even due to a higher force.

For the calculation of the base scenario it was used the First Order Decay Model according to the US EPA manual "Turning a Liability into an Asset: a Landfill Gas to Energy Handbook for Energy Handbook for Landfll Owners and Operators" (December 1994).

In this model we adopted the variables and parameters presented in the table below:

PROJECT INFO	
Landfill information	
Year when operations started	2000
Year when flaring started	2006
R = Daily average deposition (t/day)	419
Lo (cf/lb) =	1,88
k (1/ano) =	0,1
Methane Global Warming Potential	21
% of Methane in landfill gas	0,5
Project information	
Period of Credits	7 years
Efficiency adjustment factor (EAF)	20%
Flare efficiency factor	96%

The daily average of garbage disposal of 419 tons/day was obtained through adding up all the existing contracts between the garbage supply companies and Anaconda and the contracts with towns.
The value of "k" depends on the local weather conditions and residuo composition. To estimate this value we used the table of the work : "A Landfill Gás to Energy Handbook for Landfill Owners e Operators" (December 1994), part 1, pages 2-9 presented below:

Variable	Range	Suggested Values		
		Humid climate	Medium	Dry climate
Lo (cf/lb)	0-5	2,25-2,88	2,25-2,88	2,25-2,88
k (1/yr)	0,003-0,40	0,1-0,35	0,05-0,15	0,02-0,10

Source: Landfill Control Technologies, " Landfill Gás System Engineering Design Seminar", 1994

In the case of Anaconda, the weather type is humid and adopting the most conservative value we reach the number of 0.1.
According to USEPA the "Lo" factor depends on the composition of the garbage and the landfill conditions for the processing of methanizing, being the values available in the literature between 4.4 to 194 kg CH_4/ton of residue (Pelt, 1998). For the years of 1941 to 1989, the Lo value is 165 kg of CH_4/ton of residue, as suggested by USEPA (Levelton, 1991) Ortech, 1994, established a Lo for use of 117 kh CH_4/ton of residue. Therefore we are adopting conservatively this value corresponding to a Lo = 1.88 cf/lb of residue. In the case of the Anaconda Project, the EAF adopted was 20%. The methodology ACM 001 (Version 1 - Page 2) foresees the usage according to contractual and regulatory requirements for each country. In the case of Brazil, this is not required. Even so, as a conservative measure, it was adopted 20%. In the case of the flare we are adopting a efficiency factor of 96%, i.e. 4% of the biogas will be lost in the environment.

B.3. 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:

ACM0001 requires the use of the “Tool for demonstration and assessment of additionality” to show the project is not the baseline scenario. This tool is applied as follows.

Step 0. Preliminary screening based on the starting date of the project activity

a) ALGP project activity has so far being a study only. Project is expected to be operational in 31 october 2005.

b) This PDD is documented evidence that project developers have seriously considered CDM in the decision to proceed with the project activity.

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

Sub-step 1a. Define alternatives to the project activity:
Since the flaring of the gases represent just 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 results show the project does not present economically attractive results.
The only realistic alternative to ALGP is the maintenance of the situation prior to project implementation. This would incur in landfill gas release to the atmosphere through the passive venting system installed at the landfill. In that case, methane would escape and enhance the global warming effect. Also, other volatile organic compounds would be released as well. The proposed project activity not undertaken as a CDM project activity is neither credible nor realistic since it is not financially attractive.

The alternatives to the project activity are:

Option 1: the landfill operator would maintain the present activities according to the common practice of not flaring the landfill gas from its garbage operations.

Option 2: the landfill operator would invest in LFG capture and flaring.
Due to the current Brazilian legislation, the location and conditions of the landfill, the achievement of Option 2 above is not necessary. It would not be an economically attractive course of action for the landowner or for the landfill operator. Therefore its adoption is not plausible. That makes Option 1 the only plausible alternative.

Option 3: the landfill operator would invest in LFG capture and utilization to produce electricity or for comercial purposes..
Considering that the place where Anaconda is located is far for any industry or residential area, there are many technical constraints due to the distributional lines as well as infrastruture to be implemented. Moreover, there is no reason for Anaconda in spending money in a non compulsory activity.

Sub-step 1b. Enforcement of applicable laws and regulations:
In the present context the proposed baseline scenario might be described like this:
There is no gas capture and treatment in the site, only a ventilation; thus, the release of the landfill gas without obstacles will continue in these guidelines until a time in the future where the capture and treatment of landfill gas will be required by law or will become an economically attractive course of action. These alterations in the possible future of the baseline will be followed by the monitoring plan elaborated for the project.

This scenario is the base for the definition of the emission reductions of the project. Due to the uncertain gas volume to be captured by the current ventilation system, we can affirm that the volume of captured gas is low, since most of the methane is generated in the deeper layers of the landfill. The gas flux in the top of the upper layers (where the decomposition is more aerobic) is so low that no type of flaring is possible, verifying solely the ventilation. The existing contractual documents do not specify the minimum gas amount that must be captured and flared. Due to the fact that the Anaconda Landfill is far from any human housing, it is reasonable to assume that no gas amount would necessarily be flared (and not only ventilated) to minimize the risks for explosion.

As shown in A.4.4, Brazil has never enforced any law to mitigate landfill gas emissions. In state of São Paulo, CETESB, the environmental agency, has been acting towards closing rubbish dumps and forcing municipalities to give proper destination to the waste generated. 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 a demand. Passive venting at Anaconda landfill, as already considered, is the only credible and realistic alternative to ALGP.

Therefore, the situation prior to the project's implementation – the alternative to BLFGE – is in compliance with all regulations.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method
Option I – simple cost analysis – is chosen.

Sub-step 2b – Option I. Apply simple cost analysis
The Anaconda Landfill worked in the past without the LFG flaring. There are no reasons to believe that a LFG capture and flaring system would be installed for safety, operational reasons or because of the bad smell; the location of the landfill also does not require such a system be installed, because the site is very distant from any human housing. The installation of a LFG capture and flaring system, even an undeveloped one, would require costs for the landfill operator with no sort of financial compensation.

Analysis of the attractive economical aspects of the project alternative - the capture and flaring of gases produced by Anaconda Landfill - without the incomes of carbon credits. Since the flaring of the gases represent just 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 results show the project does not present economically attractive results.

Cost estimate to implement and operate Anaconda Landfill Gas Project – ALGP

Specifications	1 (year)	2 (years)	3 (years)	4 (years)	5 (years)	6 (years)	7 (years)	14 (years)	21 (years)
Term (years)	1 CER year	2 CER year	3 CER year	4 CER year	5 CER year	6 CER year	7 CER year	14 CER (8a14)	21 CER (15a21)
Construction work (Euros)	83.000	5.000	5.000	5.000	5.000	5.000	5.000	35.000	35.000
Collection network, machines and assembling work (Euros)	731.120	5.000	5.000	5.000	5.000	5.000	5.000	35.000	35.000
Monitoring – automation, equipment and software (Euros)	30.000	3.000	3.000	3.000	3.000	3.000	3.000	21.000	21.000
Unpredictable events (Euros)	84.412	1.300	1.300	1.300	1.300	1.300	1.300	9.100	9.100
Obtaining Carbon Credits (Euros)	100.000	0	0	0	0	0	0	100.000	100.000
Annual certification (Euros)	5.000	5.000	5.000	5.000	5.000	5.000	5.000	70.000	105.000
Topography, Projects, PDD, etc. (Euros)	227.936	0	0	0	0	0	0	40.415	40.415
Equipment maintenance (Euros)	29.245	29.245	29.245	29.245	29.245	29.245	29.245	409.427	614.141
Management & operation (Euros)	174.533	177.113	179.447	181.559	183.470	185.199	186.764	1.309.501	1.376.125
Watch-keeping & safety (Euros)	49.800	49.800	49.800	49.800	49.800	49.800	49.800	348.600	348.600
Financial expenses (Euros)	212.968	0	0	0	0	0	0	0	0
Equipment depreciation (Euros)	36.556	36.556	36.556	36.556	36.556	36.556	36.556	511.784	767.676
Insurance (Euros)	36.556	36.556	36.556	36.556	36.556	36.556	36.556	255.892	255.892
Total costs (annual) (Euros)	1.801.125	348.569	350.904	353.016	354.927	356.656	358.221	3.145.719	3.707.949
Accumulated costs (Euros)	1.801.125	2.149.694	2.500.598	2.853.613	3.208.540	3.565.196	3.923.416	7.069.135	10.777.084

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:
There is no similar project to ALGP being carried out in Brazil at the current moment.

Sub-step 4b. Discuss any similar options that are occurring:
Considering there is no similar activities widely observed and commonly carried out, it is not necessary to perform an analysis at this point.

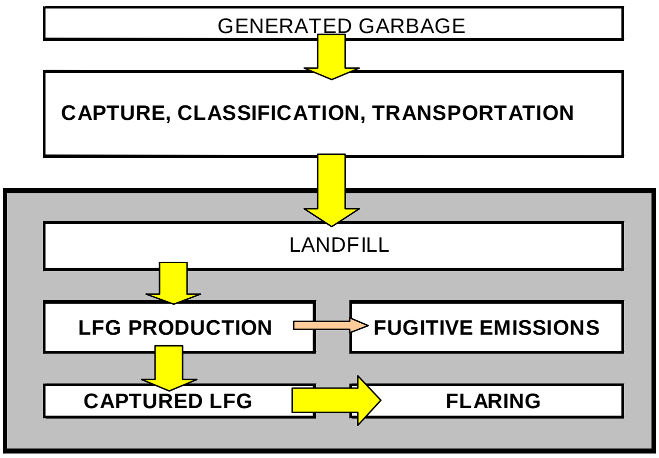
Step 5. Impact of CDM registration
Once ALGP is registered as a CDM project, it will be entitled to sell emission reductions from mathane destruction to Annex-I countries.Naturally ALGP will have a major impact in bringing new investors to the Brazilian market, as replicability will surely occur in this sort of situation. As benefit derived from the project activity, the antropogenic greenhouse gas emission reduction is indeed a very important one. Furthermore this project will atract new players to implement similar projects activities.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

The project boundary is the site of the project activity where the gas is captured and destroyed/used. Possible CO2 emissions resulting from combustion of other fuels than the methane recovered should be accounted as project emissions. Such emissions may include fuel combustion due to pumping and collection of landfill gas or fuel combustion for transport of generated heat to the consumer ocations. In addition, electricity required for the operation of the project activity, including transport of heat, should be accounted and monitored. Where the project activity involves electricity generation, only the net quantity of electricity fed into the grid should be used in equation above to account for emission reductions due to displacement of electricity in other power plants.

Where the project activity does not involve electricity generation, project participants should account for CO_2 emissions by multiplying the quantity of electricity required with the CO_2 emissions intensity of the electricity displaced.

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



B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

B.5.1 Date of completion of this section of the baseline

- 22/03/2005

B.5.2 Name of the person/entity that determines the baseline

- Herjack Engenharia e Serviços Ltda.
  Rua do Tesouro, 23 – 18o. Andar – São Paulo, SP – CEP 01015-020
  Contact e-mail: larry@herjack.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:

- 01/01/2006

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:

- 01/01/2006

C.2.1.2. Length of the first crediting period:

- 7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a monitoring methodology and plan

D.1. Name and reference of approved monitoring methodology applied to the project activity:

Approved consolidated monitoring methodology ACM0001
“Consolidated monitoring methodology for landfill gas project activities”

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

The project activities monitoring plan proposed is based on a monitoring methodology previously approved that:
(a) is determined by the designed operational entity as appropriated to the circumstances of the project activity proposed and it has been successfully used in other places; and
(b) reflects a good monitoring practice, adequate to the type of the project activity.

This 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[6]; 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 the specific case of Anaconda Landfill, the only project activity foreseen consists of flaring the captured gas. Therefore the monitoring behavior more adequate will be the direct and continuous measurement of the quantity of methane effectively flared, that will result in reductions of emission. These reductions are not calculated by comparing the scenario described in the baseline, because each ton of methane that is destroyed by the project activity will be the equivalent to a ton of methane not released in the atmosphere, there is, it will be the equivalent to a ton reduced emission; thus, the count and monitoring of the reductions of emissions do not have to be referred to the numbers of the baseline.
The reduction of emissions will be calculated using the correction Effectiveness Adjustment Factor pre-established: estimated in 20% (whatever the scenario is) and a loss estimated in about 4% due to the imperfection of the flaring.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not aplicable

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number (Please use numbers to ease cross-referencing to D.3)	*Data variable*	*Source of data*	*Data unit*	*Measured (m), calculated (c) or estimated (e)*	*Recording frequency*	*Proportion of data to be monitored*	*How will the data be archived? (electronic/ paper)*	*Comment*

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

The US EPA First Order Decomposition Model was used to obtain the estimate of the methane quantity. To have access to this Model we suggested the consult to the US EPA manual "Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators - December 1994".
The quantity that would be incinerated was discounted in the absence of the project according to the efficiency of the gas capture system and burn in the flare - see item D. 2.1.2.

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number *(Please use numbers to ease cross-referencing to table D.3)*	**Data variable**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic: e/ paper: p)**	**For how long is archived data kept?**	**Comment**
1. $LFG_{cap\&flared,y}$	*Total amount of landfill gas captured and flared*	*m3*	*m*	*continuously*	*100%*	*Paper*	*During the crediting period and two years after*	*All the captured gas will be flared, there is no electricity. Measured by a flow meter. Data to be aggregated monthly and yearly.*
2. FE	*Flare/combustion efficiency, determined by theoperation hours(1) and the methane content in the exhaust gas (2)*	*%*	*m/c*	*(1) continuously (2) quarterly, monthly if unstable*	*n/a*	*Paper*	*During the crediting period and two years after*	*(1) Periodic measurement of methane content of flare exhaust gas (2) Continuous measurement of operation time of flare (e.g. with temperature).*
3. $W_{CH4,y}$	*Methane fraction in the landfill gas*	*m3CH4/ m3LFG*	*m*	*continuously*	*100%*	*Paper*	*During the crediting period and two years after*	*Measured by continuous gas quality analyzer.*
4. T	*Temperature of the landfill gas*	*°C*	*m*	*continuously*	*100%*	*Paper*	*During the crediting period and two years after*	*Measured to determine the density of methane D_{CH4}.*
5. p	*Pressure of the landfill gas*	*Pa*	*m*	*continuously*	*100%*	*Paper*	*During the crediting period and two years after*	*Measured to determine the density of methane D_{CH4}.*

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

There are no emission sources that might be attributed to the project activity, not included in its limits, because the project does not generate energy to the exterior. The only emission leakage could be attributed to the activities of implantation of the projected system, but these might be considered insignificant; furthermore, the energy for the running of the compressors and, eventually, the burners, will come from the Brazilian energy system. According to "Balanço Energético Nacional (BEM-2004)" (Brazilian Power Balance), a publication issued by the Brazilian Ministry of Mines and Energy, over 90% of the power produced in Brazil comes from hydroelectric facilities. Generally speaking, the remaining 10% is produced by companies for their own consumption and it is not distributed through the public network. Anaconda uses power from the public distribution network, i.e., the power it uses is generated hydroelectrically.

D.2.3. Treatment of leakage in the monitoring plan

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Not applicable because there are no emission leakage in the project activity.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

There are no emission leakage in the project activity.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

The greenhouse gas emission reduction achieved by the project activity during a given year "y" (ER_y) is the difference between the amount of methane actually destroyed/combusted during the year ($MD_{project,y}$) and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{reg,y}$) 3, times the approved Global Warming Potential value for methane (GWP_{CH4}), plus the net quantity of electricity displaced during the year (EG_y) multiplied by the CO_2 emissions intensity of the electricity displaced ($CEF_{electricity,y}$)4, plus the quantity of thermal energy displaced during the year (ET_y) multiplied by the CO_2 emissions intensity of the thermal energy displaced ($CEF_{thermal,y}$). Electricity and thermal energy emission reductions apply to case (c) only.

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

ER_y is measured in tonnes of CO_2 equivalents (tCO_2e). $MD_{project,y}$ and $MD_{reg,y}$ are measured in tones of methane (tCH_4). The approved Global Warming Potential value for methane (GWP_{CH4}) for the first commitment period is 21 tCO_2e/tCH_4. EG_y is measured in megawatt hours (MWh). The CO_2 emissions intensity, $CEF_{electricity,y}$, is measured in tonnes of CO_2 equivalents per megawatt hour (tCO_2e/MWh) and ET_y is measured in TeraJoules (TJ) and $CEF_{thermal,y}$ is measured in terms of tones of CO_2 equivalents per TJ (tCO_2e/TJ).

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.

$$MD_{reg,y} = MD_{project,y} * AF$$

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. Ex ante emission estimates may have an influence on $MD_{reg,y}$. $MD_{project,y}$ will be determined *ex post* by metering the actual quantity of methane captured and destroyed once the project activity is operational.

The methane destroyed by the project activity ($MD_{project,y}$) during a year is determined by monitoring the quantity of methane actually flared and gas used to generate electricity and/or produce thermal energy, if applicable.

$$MD_{project,y} = MD_{flaret,y} + MD_{eletricity,y} + MD_{thermal,y}$$

$$MD_{flaret,y} = LFG_{flaret,y} * Wch4_{t,y} * D_{ch4} * FE$$

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 tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4).

$$MD_{electricity,y} = LFG_{electricity,y} * Wch4_{,y} * D_{ch}4$$

where $MD_{electricity,y}$ is the quantity of methane destroyed by generation of electricity and $LFG_{electricity,y}$ is the quantity of landfill gas fed into electricity generator.

$$MD_{thermal,y} = LFG_{thermal,y} * Wch4_{,y} * D_{ch}4$$

where $MD_{thermal,y}$ is the quantity of methane destroyed for the generation of thermal energy and $LFG_{thermal,y}$ is the quantity of landfill gas fed into the boiler.

For the calculation of the $MD_{project,y}$ *em (1)* we used the First Order Decay Model according to the US EPA manual “Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators” (December, 1994). The emissions will be calculated using the correction Effectiveness Adjustment Factor pre-established: estimated in 20%(0,80). The adopted equation is presented below:

$$MD_{project,y} = Lo*R\ (e^{(-kc)} - e^{(-kt)}) * 0{,}80$$
$$MD_{reg,y} = Lo*R\ (e^{(-kc)} - e^{(-kt)}) * 0{,}80 * FE_{flare}$$

Where:

$FE_{flare:}$ is the factor of efficiency of the flame in the Flare = 0,96

For the case of the Anaconda Project the values of $EG_y = ET_y = 0$, since there is not a source of electrical and thermal power in the project.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

Data (Indicate table and ID number)	**Uncertainty level of data (High/Medium/Low)**	**Are QA/ QC procedures planned for these data?**	**Outline explanation how QA/QC procedures are planned.**
D.2.2.1-1: ***LFG***$_{cap\&flared,y}$	*Low*	*Yes*	*Flow meters will be subjected to a regular maintenance and testing regime to ensure accuracy*
D.2.2.1-2: FE	*Low*	*Yes*	*Regular maintenance should ensure optimal operation of the flare. Flare efficiency should be checked quarterly, with monthly checks if the efficiency shows significant deviations from previous values.*
D.2.2.1-3: $W_{CH4,y}$	*Low*	*Yes*	*The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy.*
D.2.2.1-4: T	*Low*	*Yes*	*The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy.*
D.2.2.1-5: p	*Low*	*Yes*	*The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy.*

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The monitoring of the emission reductions is based on an operational and managerial structure which includes equipment for direct gathering of field data and processing of these data in an electronic media. Continuous measurers of gas flow and flared gas quality will be installed next to the flares in order to allow the calculation of the amount of flared gas and the fraction of methane contained in this gas. In the same way measuring of flare quality will be conducted for periodical evaluation of the efficiency of the flares.

D.5 Name of person/entity determining the monitoring methodology:

Herjack Engenharia e Serviços Ltda.
Rua do Tesouro, 23 – 18o. Andar – São Paulo, SP – CEP 01015-020
E-mail para contato: larry@herjack.com.br

SECTION E. Estimate of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

There will not be emissions due to thermal power.
The only emission related to the project is related to the Efficiency Factor in the Flare which has been estimated in 96% of the value of the base line.
In the following table we present the project emissions for the period of acquisition:

year	ton/year Project Emissions Flares
2.006	3.728
2.007	4.159
2.008	4.550
2.009	4.903
2.010	5.223
2.011	5.512
2.012	5.774
TOTAL	**33.849**

E.2. Estimate leakage:

There is no leakage, so E.2 = 0

E.3. The sum of E.1 and E.2 representing the project activity emissions:

See E.1.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

We used the "First Order Decay Model" - to account for changing gas generation rates over the life of the landfill or a proposed project.
The First Order Decay Model is more complicated than the rough approximation described above, and requires that the landfill owner/operator know or estimate five variables:

- the average annual waste acceptance rate;
- the number of years the landfill has been open;
- the number of years the landfill has been closed, if applicable;
- the potential of the waste to generate methane; and
- the rate of methane generation from the waste.

The basic first order decay model is as follows:
$LFG = 2^* Lo^*R (e^{(-kc)} – e^{(-kt)})$

Where:
LFG = Total amount of landfill gas generated in current year (cf)
Lo = Total methane generation potential of the waste (cf/lb)
R = Average annual waste acceptance rate during active life (lb)
k = Rate of methane generation (1/year)
t = Time since landfill opened (years)
c = Time since landfill closure (years)

The methane generation potential, Lo , represents the total amount of methane that one pound of waste is expected to generate over its lifetime. The decay constant, k, represents the rate at which the methane will be released from each pound of waste. If these terms were known with certainty, the first order decay model would predict methane generation relatively accurately; however, the values for L and k are thought to vary widely, and are difficult to estimate accurately for a particular landfill. The values for L and k are dependent in part on local climatic conditions and waste composition; therefore, a landfill owner/operator may want to consult others in the local area, with similar landfills who have installed gas collection systems to narrow the range of potential values. On March 12, 1996, EPA issued final regulations for the control of landfill gas at new and existing municipal solid waste landfills with design capacities of 2.5 million metric tons or more.
The value of “K” depends on the local weather conditions and composition of residue. To estimate this value we used the table from the work “A Landfill Gás to Energy Handbook for Landfill Owners e Operators" (december 1994), part 1, pages 2-9, present below:

Variable	Range	Suggested Values		
		Humid Climate	Medium	Dry climate
Lo (cf/lb)	0-5	2,25-2,88	2,25-2,88	2,25-2,88
k (1/yr)	0,003-0,40	0,1-0,35	0,05-0,15	0,02-0,10

Source: Landfill Control Technologies, “ Landfill Gás System Engineering Design Seminar”, 1994

In the case of Anaconda, the weather type is humid and adopting the most conservative value we reach the number of 0.1.

According to USEPA the "Lo" factor depends on the composition of the garbage and the landfill conditions for the processing of methanizing, being the values available in the literature between 4.4 to 194 kg CH4/ton of residue (Pelt, 1998). For the years of 1941 to 1989, the Lo value is 165 kg of CH4/ton of residue, as suggested by USEPA (Levelton, 1991) Ortech, 1994, established a Lo for use of 117 kh CH4/ton of residue. Therefore we are adopting conservatively this value corresponding to a Lo = 1.88 cf/lb of residue.

For the landfill case we are adopting a natural flaring of CH4 of 20% considering the factor of efficiency adjustment. . In the case of the Anaconda Project, the EAF adopted was 20%. The methodology ACM 001 (Version 1 - Page 2) foresees the usage according to contractual and regulatory requirements for each country. In the case of Brazil, this is not required. Even so, as a conservative measure, it was adopted 20%.

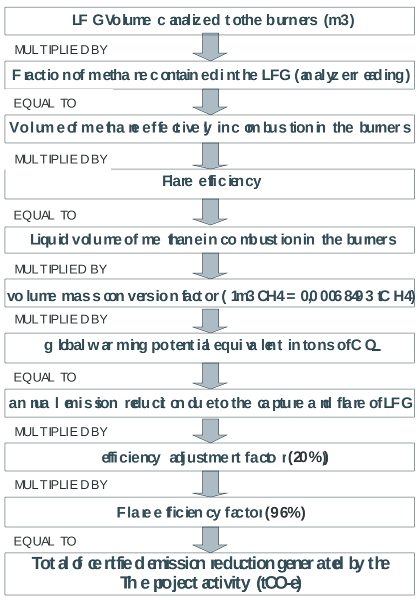
As for the flares we are adopting a efficiency factor of 96%, i.e. 4% of the biogas will be lost in the environment. We are using a value much higher of losses, which favors safety for the calculations of ERCs.

For the landfill garbage disposal the history was not considered, making the obtained numbers in favor of safety. We are using only the disposals from the first year of credit. The disposal considered value is based on the current contracts signed with garbage companies as well as the towns.

For safety reasons we are not considering the increase in the efficiency of the project.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The emissions reductions from the LFG incineration will be calculated according to the sequence below:



E.6. Table providing values obtained when applying formulae above:

year	ton/year Reduction Emission
2.006	89.469
2.007	99.825
2.008	109.196
2.009	117.675
2.010	125.347
2.011	132.289
2.012	138.571
TOTAL	**812.374**

SECTION F. Environmental impacts

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

Collection and flaring of landfill gas results in destruction of other gases besides methane. These emissions include volatile organic compounds and sulphur dioxides, among others. These emissions are not considered in this assessment. If the project subsequently decides to offset electricity from the grid, emissions of ozone and nitrogen oxides that would otherwise be generated from fossil fuels are avoided. These impacts are all of a positive nature but have not been quantified. They contribute to the overall sustainable development attributes of the project. Facing this scenario, we can affirm that any impact that the project activity might cause will necessarily be positive and will bring benefits to the environment as a whole.

Licenses list:

- Licença de instalação
  nº 38000301 – Processo nº 38/00138/02 – Data 03/09/2004.

- Licença de Funcionamento
  nº 38000063 – Processo nº 15/00036/99 – Data 21/02/2001.

- Licença de Operação a Título Precário
  nº 38000100 – Processo nº 38/00138/02 – Data 21/09/2004.

See Annex 6.

F.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 applicable.

SECTION G. Stakeholders' comments

Considering the location of Anaconda Landfill, the precautions that are currently taken concerning the environment, including the monitoring of the water tables, the project activity can only bring a positive environmental contribution, by reducing the GHG emissions to the atmosphere. So, no negative impacts are identified and hence no measures need to be taken.

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

According to the Resolution 1 of the Global Weather Change Inter-ministerial Commission, issued in December 2nd 2003, the decree from July 7th 1999, every project based on the Project Conception Document (PDD), the Clean Development Mechanism - MDL must be sent to the Global Weather Change Inter-ministerial Commission Executive Secretary, as well as the copies of the comment invitations sent by the project prospect to the following agents involved and affected:

- **Benedito Roberto de Castro - Substitute**
  Entity: ONG Oasis
  Address: Av Coronel Bertoldo, 305 - Centro
  ZIP Code: 07500 000 - City: Santa Isabel/SP
  Phone: 011 46564350
  E-MAIL: ptatopografia@uol.com.br

- **Pedro Bellini Júnior - President**
  Entity: OAB
  Address: Rua José Bonifácio, 28
  ZIP Code: 07500-000 - City: Santa Isabel/SP
  Phone: 011 46562757
  E-MAIL: dr.claudiogomes@ig.com.br

- **Roberto Drumont Melo da Silva - Member**
  Entity: Jornal Ouvidor (ABS – Sistema Educacional)
  Address: Diogo Batista Nunes ,120 salas 04/06
  ZIP Code: 07500 000 - City: Santa Isabel/SP
  Phone: 011 46562333
  E-MAIL: editor@jornalouvidor.com.br

- **Sandra Yoko Barbosa - Member**
  Entity: Associação Comercial e Industrial de Santa Isabel
  Address: Av. Prefeito João Pires Filho, 40 - Centro
  ZIP Code: 07500-000 - City: Santa Isabel/SP
  Phone: 011 46562798
  E-MAIL: sandrayib.projetos@ig.com.br

- **Hélio Buscarioli - Mayor**
  Entity: Prefeitura Municipal de Santa Isabel
  Address: Av: Republica ,297
  ZIP Code: 07500 000 - City: Santa Isabel - SP
  Phone: 011 46561000
  E-MAIL: premusi@osite.com.br

- **Ademar Ramos Barbosa – Vice-Mayor**
  Entity: Prefeitura Municipal de Santa Isabel
  Address: Av: Republica, 297 Centro
  ZIP Code: 07500 000 - City: Santa Isabel - SP
  Phone: 011 46574783
  E-MAIL: dae@santaisabel.sp.gov.br

- **Dr. Luíz Roberto Barrada Barata**
  Entity: Secretaria de Estado da Saúde
  Address: Av. Dr. Enéas de Carvalho Aguiar, 188
  ZIP Code: 05403-000 - City: São Paulo / SP
  Phone: 011 30668000

- **Dr. Rubens Lara - President**
  Entity: Companhia de Tecnologia de Saneamento Ambiental – CETESB
  Address: Av. Prof. Frederico Hermann Jr., 345 - Alto de Pinheiros
  ZIP Code: 05459-900 - City: São Paulo – SP
  Phone: 011 30306085
  E-MAIL: rubenslara@cetesb.sp.gov.br

- **Nome: José Goldenberg**
  Entity: Secretaria do Meio ambiente do Estado de São Paulo
  Address: Av. Prof. Frederico Hermann Jr., 345 - Alto de Pinheiros
  ZIP Code: 05459-900 - City: São Paulo – SP
  Phone: 011 30306154
  E-MAIL: jgoldenberg@sp.gov.br

- **Tenente Marcelo Robis Francisco Nassaro – Chefe de Relações Públicas do Departamento de Comunicação Social (Public Relations Chief of Social Communication Department)**
  Entity: Comando de Policiamento Ambiental
  Address: Av. Prof. Frederico Hermann Jr., 345 – Prédio 1 – 4º andar - Alto de Pinheiros
  ZIP Code: 05459-900 - City: São Paulo – SP
  Phone: 011 30306625
  E-MAIL: cpambp5@polmil.sp.gov.br

- **Dra Estefania Ferrazzini Paulin – Promotora de Justiça de Meio Ambiente**
  Entity: •Ministério Público de Santa Isabel – Promotoria de Justiça
  Address: Praça da bandeira, s/nº - Fórum – Centro
  ZIP Code: 07500-000 – Santa Isabel
  Phone: 011 4656-3836 / 011 4656-9724
  E-MAIL: tjsantaisabel@mp.sp.gov.br

- **Ubirajara Tanuri Felix – Construction Director**
  Entity: Departamento de Águas e Energia Elétrica – DAEE
  Address: Rua Boa Vista, 170 – 8º andar – bloco 05
  ZIP Code: 01014-000 - City: São Paulo - SP
  Phone: 011 32938571
  E-MAIL: ufelix@sp.gov.br

- **Nome: Dr. Guilherme Augusto Cirne de Toledo**
  Entity: Companhia Energética de São Paulo – CESP
  Address: Av. Nossa Senhora do Sabará, 5312-E
  ZIP Code: 04447-011 - City: São Paulo-SP
  Phone: 011 56132100
  E-MAIL: guilherme.toledo@cesp.com.br

- The interested parts were invited to provide comments on the activities and the project during a 30-day term after the comment invitations are received. Araúna and Anaconda Ambiental were prepared to answer any questions and doubts about the project, during this period. The letters will be distributed by Anaconda Ambiental via mail to the institutions mentioned above. The project will be at public disposal in the company's website in English and Portuguese versions. The letters were sent between March 22nd to 30th 2005. The period for comments will be from March 30th to April 30th 2005.

G.2. Summary of the comments received:

See Annex 9.

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

No relevant comments were received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Anaconda Ambiental Empreendimentos Ltda
Street/P.O.Box:	Rua José Felix de Oliveira, 836 - Granja Viana
Building:	
City:	Cotia
State/Region:	São Paulo
Postfix/ZIP:	06708-645
Country:	Brasil
Telephone:	55 11 4612-0102
FAX:	55 11 4612-0102
E-Mail:	anacondaambiental@uol.com.br
URL:	
Represented by:	
Title:	Solicitor
Salutation:	Mr.
Last Name:	Arteiro
Middle Name:	de Mendonça
First Name:	Ricardo
Department:	
Mobile:	
Direct FAX:	55 11 4612-0102
Direct tel:	55 11 4612-0102
Personal E-Mail:	

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:	Brasil
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

As presented previously, the methodology of the baseline identifies two alternative scenarios (the BAU scenario and the proposed project activity). The first without the biogas flare and the second using flares where, in the adopted premise, 96% are burned.
To estimate the amount of incineration that would occur in the absence of the project, it was necessary to estimate the future emissions of the landfill gas (the methodology proposed uses the US EPA First Order Decomposing Model) and subtract the quantity of landfill gas that would be incinerated considering the efficiency of the gas capture systems.
Once the project becomes operational, the emission reductions associated to the project can be calculated directly, through the measuring of the quantity of incinerated methane.
The following table shows the main data and the presuppositions in the Anaconda Landfill case.

LFG= 2 x Lo x R (e^(-kc) - e^(-kt))			current year total of generated landfill gas
Lo	1,88	cf/lb	potential amount of generated methane gas
R	419	t/day	
R	152.935	t/year	
R	152.935.000,00	kg/year	
R	337.160.501,00	lb/year	garbage deposition tax
t	6	years	time since landfill inauguration
c	0	years	time since landfill closing
k	0,1	1/year	landfill gas generation tax

Convertion Table		
1cf=	0,0283	m3
1m3=	35,3107	cf
1lb=	0,4536	kg
1kg=	2,2046	lb
1CH4	21,0000	CO2
1LFG	0,5000	CH4
1CH4m3	0,00068493	CH4ton
EAF	20%	
FLARE	96%	

			LFG				CH4					CO2			
t	c	year	pes3 (cf)/year	m3/year	m3/year Loss total escape	m3/hour Loss total escape	m3/year	ton/year	m3/year Loss total escape	ton/year Loss total escape	ton/year Reduction emission Flares	ton/year	ton/year Baseline	ton/year Reduction emission Flares	ton/year Project emissions Flares
				(a)	(b)=(a) x0,80		(c)	(d)	(e)=(c) x0,8	(f)=(d) x0,8	(g)=(f) x0,96	(h)	(i)=(h) x0,8	(j)=(i) x0,96	(h)=(i) x0,04
6	**0**	**2.006**	571.982.085	16.198.533	12.958.826	1.479	8.099.266	5.547	6.479.413	4.438	4.260	116.496	93.197	89.469	3.728
7	0	2.007	638.190.632	18.073.559	14.458.847	1.651	9.036.779	6.190	7.229.423	4.952	4.754	129.981	103.985	99.825	4.159
8	0	2.008	698.098.604	19.770.152	15.816.122	1.805	9.885.076	6.771	7.908.061	5.416	5.200	142.183	113.746	109.196	4.550
9	0	2.009	752.305.578	21.305.294	17.044.235	1.946	10.652.647	7.296	8.522.118	5.837	5.604	153.223	122.578	117.675	4.903
10	0	2.010	801.354.077	22.694.347	18.155.478	2.073	11.347.174	7.772	9.077.739	6.218	5.969	163.213	130.570	125.347	5.223
11	0	2.011	845.734.994	23.951.215	19.160.972	2.187	11.975.608	8.202	9.580.486	6.562	6.299	172.252	137.802	132.289	5.512
12	0	2.012	885.892.508	25.088.476	20.070.781	2.291	12.544.238	8.592	10.035.390	6.874	6.599	180.431	144.345	138.571	5.774

ACCUMULATED

		2.006	571.982.085	16.198.533	12.958.826		8.099.266	5.547	6.479.413	4.438	4.260	116.496	93.197	89.469	3.728
		2.007	1.210.172.717	34.272.091	27.417.673		17.136.046	11.737	13.708.837	9.390	9.014	246.477	197.182	189.295	7.887
		2.008	1.908.271.321	54.042.244	43.233.795		27.021.122	18.508	21.616.898	14.806	14.214	388.660	310.928	298.491	12.437
		2.009	2.660.576.899	75.347.538	60.278.030		37.673.769	25.804	30.139.015	20.643	19.817	541.883	433.506	416.166	17.340
		2.010	3.461.930.976	98.041.885	78.433.508		49.020.943	33.576	39.216.754	26.861	25.786	705.096	564.077	541.514	22.563
		2.011	4.307.665.970	121.993.100	97.594.480		60.996.550	41.778	48.797.240	33.423	32.086	877.348	701.878	673.803	28.075
		2.012	5.193.558.478	147.081.576	117.665.261		73.540.788	50.370	58.832.630	40.296	38.684	1.057.778	846.223	812.374	33.849

AVERAGE

		2.006	571.982.085	16.198.533	12.958.826		8.099.266	5.547	6.479.413	4.438	4.260	116.496	93.197	89.469	3.728
		2.007	605.086.358	17.136.046	13.708.837		8.568.023	5.869	6.854.418	4.695	4.507	123.239	98.591	94.647	3.944
		2.008	636.090.440	18.014.081	14.411.265		9.007.041	6.169	7.205.633	4.935	4.738	129.553	103.643	99.497	4.146
		2.009	665.144.225	18.836.884	15.069.508		9.418.442	6.451	7.534.754	5.161	4.954	135.471	108.377	104.042	4.335
		2.010	692.386.195	19.608.377	15.686.702		9.804.189	6.715	7.843.351	5.372	5.157	141.019	112.815	108.303	4.513
		2.011	717.944.328	20.332.183	16.265.747		10.166.092	6.963	8.132.873	5.570	5.348	146.225	116.980	112.300	4.679
		2.012	741.936.925	21.011.654	16.809.323		10.505.827	7.196	8.404.661	5.757	5.526	151.111	120.889	116.053	4.836

NOTE: To calculate the biogas the US EPA First Order Decompositon Model equation was used.
"Turning a Liability into an Asset: A landfill Gas to Energy Handbook for Landfill Owners and Operators" (12/1994)

PROJECT INFO

Landfill information	
Year when operations started	2000
Year when flaring started	2006
R = Daily average deposition (t/day)	419
Lo (cf/lb) =	1,88
k (1/ano) =	0,1
Methane Global Warming Potential	21
% of Methane in landfill gas	0,5

Project information	
Period of Credits	7 years
Efficiency adjustment factor (EAF)	20%
Flare efficiency factor	96%

RESULTS

Gas and Methane produced in the Landfill	7 years
Total of gas (m3)	147.081.576
Total of Methane (t)	50.370

Decrease in landfill's emissions (tCO2e)	Emissions Base line	Emissions Project	Decrease Emissions
7 years	846.223	33.849	812.374

Annex 4

MONITORING PLAN

Approved consolidated monitoring methodology **ACM0001**
"Consolidated monitoring methodology for landfill gas project activities"

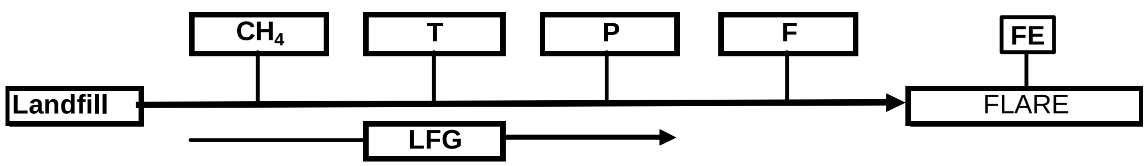
Applicability
This methodology is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include situations such as:
a) The captured gas is flared; or
b) The captured gas is used to produce energy (e.g. electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources (1); 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.

(1) Although in this case no emission reductions are claimed for displacing or avoiding energy from other sources, all possible financial revenues and/or emission leakages shall be taken into account in all the analyses performed.

This monitoring methodology shall be used in conjunction with the approved baseline methodology ACM0001 ("Consolidated baseline methodology for landfill gas project activities").

Monitoring Methodology
The monitoring methodology is based on direct measurement of the amount of landfill gas captured and destroyed at the flare platform and the electricity generating/thermal energy unit(s) 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 ($MD_{flared,y}$) and the quantity of methane used to generate electricity ($MD_{electricity,y}$)/thermal energy ($MD_{thermal,y}$).

Figure 1: Monitoring Plan



Mesure	
CH_4	Fraction of CH_4
T	Temperature
P	Pressure
F	Flow of LFG (m^3)
FE	Flare Efficiency

To determine these variables, the following parameters have to be monitored:
– The amount of landfill gas generated (in m³, using a continuous flow meter), where the total quantity ($LFG_{total,y}$) as well as the quantities fed to the flare ($LFG_{flare,y}$), to the power plant ($LFG_{electricity,y}$) and to the boiler ($LFG_{thermal,y}$) are measured continuously. For $LFG_{electricity,y}$ and to the boiler $LFG_{thermal,y,}$, the fraction of methane in the landfill gas ($w_{CH4,y}$) should be measured with a continuous analyzer or, alternatively, with periodical measurements, at a 95% confidence level , using calibrated portable gas meters and taking a statistically valid number of samples and accordingly the amount of land fill gas from $LFG_{total,y}$, $LFG_{flare,y}$, $LFG_{electricity,y}$, and $LFG_{thermal,y}$ shall be monitored in the same frequency. The continuous methane analyser should be the preferred option because the methane content of landfill gas captured can vary by more than
20% during a single day due to gas capture network conditions (dilution with air at wellheads, leakage on pipes, etc.).
– The flare efficiency (*FE*), measured as the fraction of time in which the gas is combusted in the flare multiplied by the efficiency of the flaring process. For this purpose, the methane content of the flare emissions should be analysed at least quarterly, and where necessary more frequent, to determine the fraction of methane destroyed within the flare.
– Temperature (*T*) and pressure (*p*) of the landfill gas are required to determine the density of methane in the landfill gas.
– The quantities of electricity or any other fuels required to operate the landfill gas project, including the pumping equipment for the collection system and energy required to transport heat, should be monitored.
– Relevant regulations for LFG project activities shall be monitored. Changes to regulation should 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 should explain how regulations are translated into that amount of gas.

The measurement equipment for gas quality (humidity, particulate, etc.) is sensitive, so a strong QA/QC procedure for the calibration of this equipment is needed.

QA/QC PROCEDURES

The actions of quality guarantee that will be implemented in the context of the Anaconda Project are the following:

Process planning: an implantation and operation process planning for the Anaconda Project will be elaborated, in which the following will be defined: objectives and goals of the Project and its respective deadlines, attributions and responsibilities of the technical personnel involved directly or indirectly in the services, system for document and process registering control, system for communication with the other prospects, system for controlling of the operation and the measuring and monitoring devices, maintenance of equipment, quality auditing, parameters of the monitoring process and operation, analysis of the collected data, system for the making of corrective actions, preventive actions and process improvement actions.

Maintenance Plan: A Maintenance Plan will be elaborated, aiming at obtaining the maximum 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.

Documents of quality: documents will be elaborated containing instructions for the execution of the main activities attributed to the involved technical personnel of Anaconda Landfill, to guarantee that they will be done in conformity to the specified requirements.

Process Register: the registers to be generated will be defined for the variables of the process to be monitored already indicated, as well as to confirm the proceeding of the control activities and quality guarantee, in a way that allows the tracking of the process in any moment of the Project. For each register a system of identification, periodicity of capture/detection, storage, protection, recovery, retention and disposing time will be defined, when applicable.

Register of Field Monitoring: The monitoring of the variables of the process indicated previously will be continuously carried out in order to ensure the follow up of its behavior 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. At first these registers will be gathered "in loco" and written down in spread sheets or through telemetry equipment and digitally stored in the form of data bank with access determined by a granting policy.

Calibration of the measurement equipment: The calibration of the measurement equipment and/or monitoring will be done periodically, according to 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..

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. Eventual unsolved matters that are detected will be registered for the proper action taking, including corrective maintenance, whenever necessary.

Unsolved task warning: Following the checkup, a "unsolved task warning" is sent to the technical staff of the place, listing all the tasks considered necessary by the managing team. This is verified in the subsequent checkups to secure that these tasks were carried out. Registers of these checkups will be filed, as well as the items and services verified.

Quality auditing: Teams formed by capable technical staff that are not directly involved in the Project will conduct quality audits with the purpose of evaluate the adequacy of the operation being carried out in relation to the previously elaborated planning.
The resulting observations of eventual deviations will be reported and sent to the responsible people for the proper actions, so that they can be solved in the shortest possible time.

Corrective, Preventive and Improvement Actions: 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:

- An analysis of the non-conformity and its causes will be conducted immediately by the Anaconda Landfill staff;
- The Anaconda Landfill administration will make a decision about the corrective actions adequate to eliminate the non-conformity and its causes;
- Corrective actions are implemented and reported to the Anaconda Landfill administration.

If non-conformities that might occur are detected, a similar procedure will be adopted on Preventive Action taking and register.
On the other hand, improvements that might be incorporated in the process will be registered and followed through Improvement Actions.
All these actions will be guided to the accomplishment of the objectives and goals established in the service planning.

Besides the quality guarantee measures described above, the Anaconda Landfill team will prepare a Operation Manual that will include procedures for training, capacitating, providing and adequate treatment of the equipment, infra-structure and working environment, emergency and safety at work plans. The Anaconda Landfill team will also guarantee the provision of human and material resources predicted in the service planning and necessary for the accomplishment of the activities, so that all the professionals involved will receive adequate training about the implementation of this Monitoring and Project Plan.