Lara Co-Geração e Comércio de Energia Ltda

Landfill gas to energy project at Lara landfill, Maua, Brazil

Project Design Document

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F A C T R

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Landfill gas to energy project at Lara landfill, Maua, Brazil

A.2 Description of the project activity

Objectives and project activity

The ***main objective*** of the project is to capture landfill gas emitted from the large quantities of degrading solid municipal waste which have already been deposited at the Lara landfill and which are to be added yet until the planned closing of the landfill site in 2014. Landfill gas contains approx. 50% of methane (CH4), which is a powerful greenhouse gas (GHG) contributing to global warming and climate change, besides creating fire hazard on the landfill. In addition, the landfill gas causes bad odours in the vicinity of the landfill. Thus, by capturing and combusting the landfill gas, global GHG emissions are reduced significantly, local environmental impacts are mitigated and operational safety is increased.

The ***project activity*** consists in installing, operating and maintaining a comprehensive landfill gas capturing and flaring system with a pilot gas engine/generator set of 1 MW_{el} in the years 2004/2005 (phase 1), followed by the installation of additional gas engines & power generator sets of up to 10 MW_{el} in the years 2005/2006 (phase 2) at the existing Lara landfill, Mauá, Brazil. In parallel, the introduction of enhanced waste management practice incl. social activity programs aiming at improving the living situation of the local stakeholders are planned. For this purpose, a project company has been established, named Lara Co-Geração e Comércio de Energia Ltda (in short “Lara Energia”).

For ***financing*** the total investment of approx. 14 mio. US$, but also for covering the operation and maintenance costs of the necessary equipment to be installed, the project aims at making use of the flexible mechanisms provided by the Kyoto Protocol, namely the Clean Development Mechanism (CDM). By registering the project under the CDM, Certified Emission Reduction units (CERs, 1 CER is equivalent to 1 ton of CO_2 reduced) will be generated and transferred to private or public buyers abroad, thus assisting those entities with their GHG reduction compliance.

The Lara landfill

The Lara landfill is located in the metropolitan area of São Paulo, in an industrial area of the municipality of Mauá. The site receives approx. 1'500 tons/day of municipal and some small quantities of industrial solid waste from the surrounding municipalities Mauá, Ribeirão Pires, Diadema, São Bernardo do Campo, Rio Grande da Serra and São Caetano do Sul. The landfill has been operated since 1987 and received until today approx. 5.5 million tons of refuse. Until the closure of the landfill expected for 2014, another 5.9 mio. tons of waste will be deposited.

Figure 1: Arial view of the Lara landfill

The landfill is owned and operated by the private company Lara Comércio e Prestação de Serviços Ltda, who holds all necessary licences of the local and state authorities to operate the landfill as well as waste disposal contracts with the municipalities mentioned above. The Lara landfill thus complies with all relevant technical, environmental and safety obligations. For example: The landfill base is coated with an impermeable high density polyethylene liner; covering is done with local soil; a leachate collection system with physical-chemical and biological leachate treatment is in operation; for safety reasons, 60 passive atmospheric gas venting stations with vertical, perforated concrete pipes are installed.

Based on current national or state legislations in Brazil, no landfill gas collection, flaring or any other treatment is required. Most landfills in Brazil do not even have *gas venting!* At the Lara landfill, an estimated 5 to 10% of the total amount of landfill gas produced is currently

flared and thus destroyed, i.e. by occasionally and manually igniting the vented gas at about 30 of the 60 venting pipes.

Environmental impacts and contribution to sustainable development

The major benefit of the project is the ***reduction of approx 500'000 tons of methane emissions*** over the whole project life, compared to the current situation. Methane (CH_4) is a 21-times stronger greenhouse gas than CO_2, thus emissions reductions of approx. 10.5 million. tons of $CO_{2\ equivalent}$ accrue in total. No additional emission reductions are intended to be claimed from production of electricity (phase 2), i.e. from the displacement of CO_2-intensive grid electricity.

Further on, following ***local environmental benefits*** arise as a result of the project implementation:

- Reduction of emissions of toxic gases, such as CO, NO_2, SO_2, H_2S, etc.
- Improved landfill cover, thus reducing the amount of leachate/spill water
- Improved leachate pumping, thus reducing the risk of water/groundwater pollution
- Significant reduction of bad odours
- Further reduction of the fire hazard

It is the declared intention of the project company Lara Energia to share parts of the revenues from the generation and sales of carbon credits with the local stakeholders, by initiating a comprehensive social activity program linked with an innovative waste management concept, covering, among others:

- ***Waste separation project:*** To support a waste separation and recycling project run by the municipality of Mauá. Involving today 50 waste scavengers, this program recycled in the last years about 30'000 tons of municipal waste. The target of the support by Lara Energia is to increase significantly the number of scavengers employed and the amount of waste to be recycled.
- ***Environmental education program:*** Train public school teachers to lecture environmental educational programs in their schools. Organise guided visits to the Lara landfill and the waste treatment facilities. Partnerships with superior technical schools offering support for research on environmental issues.
- ***Adults alphabetisation program:*** Partnership with an existing alphabetisation program, called MOVA – Movimento de Alfabetização de Jovens Adultos. Covering the costs for teachers, schoolrooms, books and materials.
- ***Partnership with the CAJUS–Project by the municipality of Mauá:*** This program trains and qualifies young people in poor areas in skills like electrical works, information technology, shop assistance, vegetable gardening, hairdressing, culinary art, sewing, manicure, etc.

- ***Support of closed suburb Vila Carlina:*** Vila Carlina, located 2 km of the LARA landfill has a population of about 2'000 inhabitants. This poor area suffers of threat of landslides, open air sewage and a lack of basic medical support and leisure installations.

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

- Increased tax income for the municipality of Mauá, the state and the national Government based on the project company's operational results.
- Improvement of the economic and social situation of local stakeholders due to the project and the planned social activities/programs (new employment, alphabetisation, improved safety on the landfill).
- Enhancement of the environmental situation in the global (reduced green house gas emissions) and local context (less water pollution, reduced toxic air emissions and bad odours).
- Transfer on state-of-the-art landfill management technology yet largely unknown in Brazil and dissemination of information thereon to all interested parties.

A.3 Project participants

Owner and operator

Lara Co-Geração e Comércio de Energia Ltda is a company recently established with the sole purpose to build, own and operate the new landfill gas to energy system, i.e. to explore landfill gas, to generate and export electricity and to generate and transfer carbon credits accruing from the project activity. Lara Comércio et Prestação de Serviços Ltda, the current owner and operator of the landfill, is the major shareholder in Lara Co-Geração; two private persons are minority shareholders.

For general questions or comments related to any aspect of this project please contact (in Portuguese or English):
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Bairro Sertãozinho, CEP n. 09370-840, Mauá-SP, Brazil, www.laraenergia.com.br
Mr. Ralf LATTOUF, Local Project Manager, E-mail: ralf.lattouf@laraenergia.com.br,
Direct phone: +55 11 5094-0494

For issues related specifically to the generation and transfer of CER please contact (in English):
Factor Consulting + Management AG, Binzstrasse 18, 8045 Zurich, Switzerland, www.factorag.ch
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Direct phone: +41 1 455 61 05

A.4 Technical description of the project activity

A.4.1 Location of the project activity

Host country Party: Brazil

State: Sao Paulo

City: Municipality of Mauá

Location:

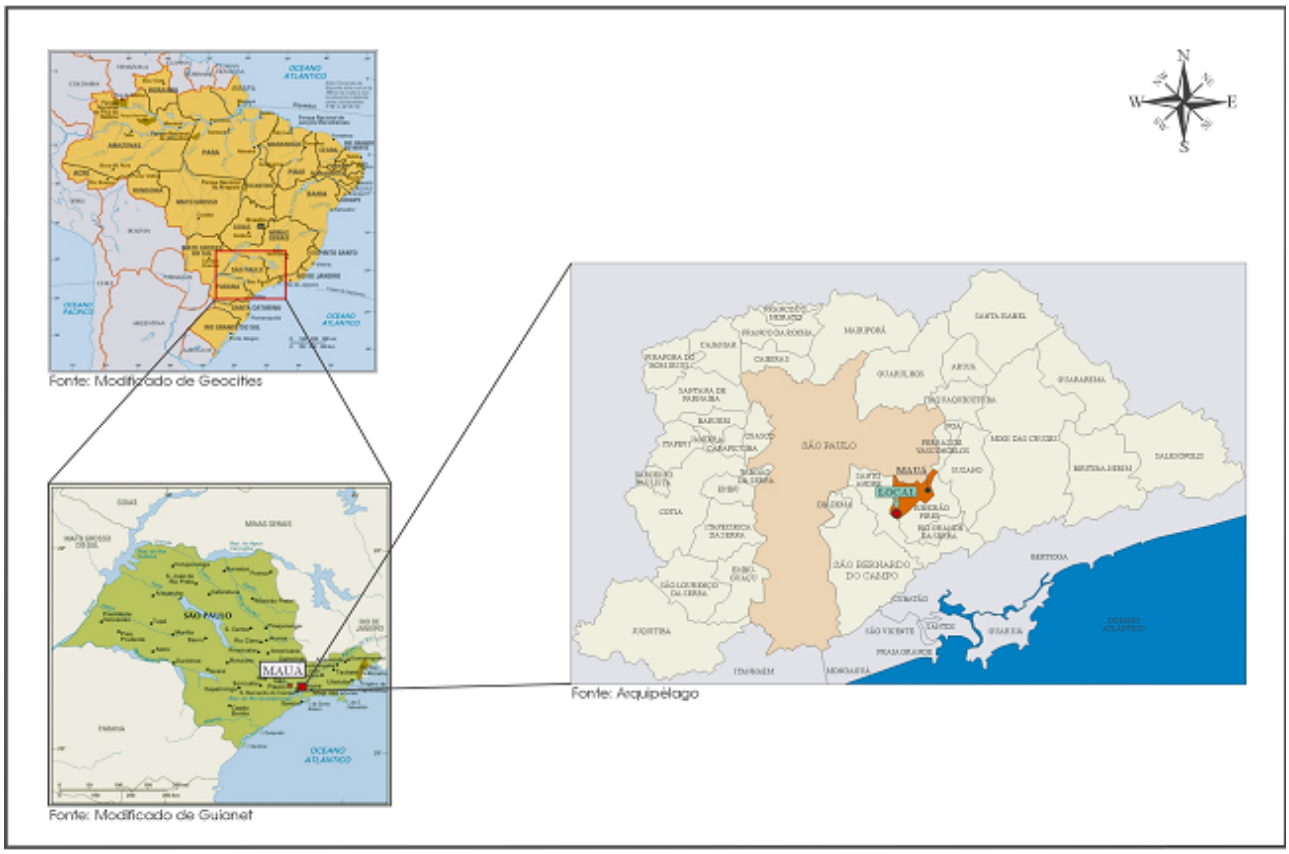

Figure 2: Location of the Lara landfill

A.4.2 Category(ies) of project activity

Landfill gas recovery and conversion to electricity

Note: Official project categories are not yet defined/published by the UNFCCC secretariat

A.4.3 Technology to be employed by the project activity

Installations

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

The adaptation of the landfall will be done in two phases:

Phase 1 (July 2004 – July 2005): A gas collection system with collecting pipes, manifolds, blowers and monitoring & control systems will be installed. About 30 existing wells will be equipped with well heads connected to the gas collecting system. Another 30 to 50 new wells will be drilled and connected to the gas collection system. The new wells will be spread throughout the whole landfill. Beside the gas extraction, these wells will also serve as leachate drains. Additionally a horizontal gas collecting system will be installed in the landfill operation (disposal) area. This will allow gas collection without interfering with the landfill operation. Adequate flaring capacity (12'000 - 14'000 m^3/h) will also be installed.

A gas engine / generator set with a capacity of 1 MW_{el} will be installed to be operated by parts of the landfill gas collected. The objective is to cover the entire electricity demand of the landfill installations. The aim is also to collect about 8'000 m^3 / hour of landfill gas until the end of 2004.

Based on the experience and monitoring data of the first year of operation, the landfill gas collecting system will be expanded in the years 2005 and 2006 by adding additional wells and horizontal colleting pipes. The project previews a total of 100 to 120 gas wells producing about 14'000 m^3 / h at the time of the landfill closure (2014).

Phase 2 (starting July 2005): Depending on the Power Purchase Agreement to be achieved, additional and larger gas engines and generators with a total capacity of up to 10 MW_{el} will be installed, producing up to 80’000 MWh of electricity per year, to be fed into the high voltage grid of the local utility.

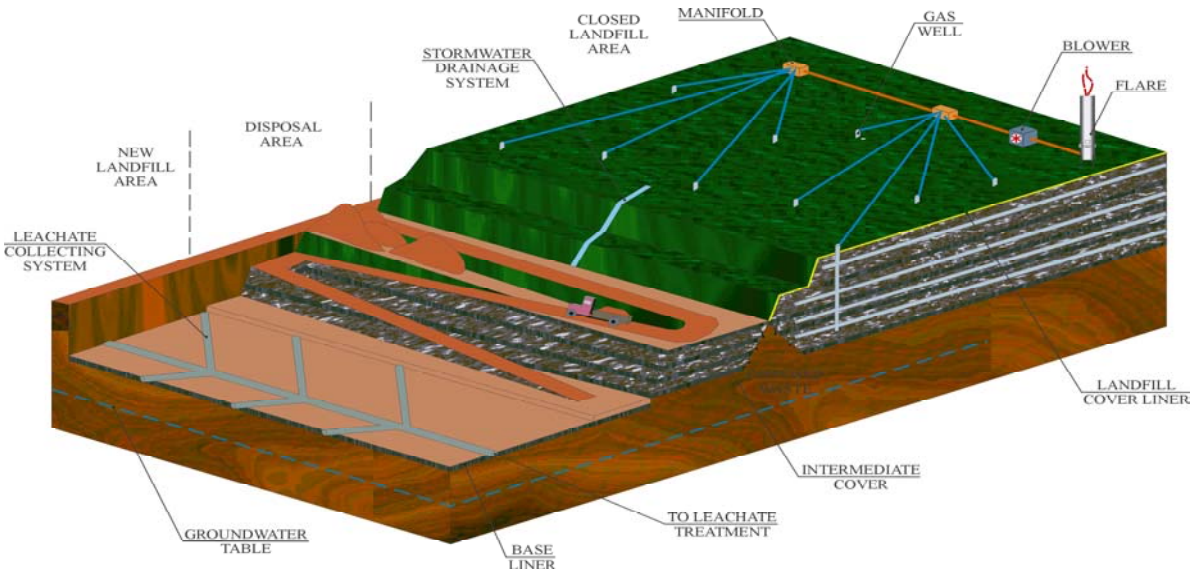

Figure 3: Sectional drawing of a landfill with gas collection / flaring system

Technology transfer

Many components employed will have to be imported, since they are not commercially available in Brazil, due to the fact that landfill gas recovery is not required by law and practised very rarely. Thus, a significant transfer of technology takes place, involving the import of proven, state-of the-art equipment of international technology providers complying with latest international standards, in regard to quality, operational safety and environmental aspects.

During both phases of the project implementation extensive trainings of staff members that handle the new technology will be conducted to ensure a sustainable operation and maintenance of the installation. In addition, the project owner will sign maintenance contracts with equipment suppliers if considered sensible.

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

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

Table 1: Major components and technologies transferred incl. standards adhered to

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

National/sectoral policies

In Brazil, municipal solid waste generation is estimated to be around 54'000 tons per day, with its composition varying according to each region. Solid waste disposal and treatment is distributed in the following way: 76% are deposited in open dumps, 22% in controlled and sanitary landfills, and 2% have other destinations, such as composting plants and incineration. Increasing urbanization limits the areas available for final waste disposal. Large cities often export their waste to neighbouring municipal district areas. In many other cases, inappropriate areas are chosen as temporary dumps, which with time become permanent [1].

The Brazilian legislation does not require landfill gas to be flared (Decreto Lei Estadual 8.468/76). The only requirement, however, is the venting of landfills for safety purposes, i.e. to avoid fires and explosions. Neither flaring of landfill gas, nor active extraction and subsequent generation of electricity is required.

A new waste management policy "national politic for solid waste" has been under discussion for many years but no changes are anticipated, at least for the short- to medium-term. Even such a policy change would take place sometime, it is unclear whether such legal requirements could be implemented/enforced in practice, since the majority of landfills are struggling already with much more basic requirements stipulated by the current law, such as water contamination by leachate, exposed waste, etc. [2]

Currently, no landfill in Brazil is equipped with comprehensive gas capturing, flaring and energy recovery (electricity production) systems, such as the planned project. This assessment is supported by the Ministry of Environment which considered the amount of methane recovered or burned to be insignificant in Brazil[1]. However, several similar (CDM) projects are planned or under implementation, e.g. at Salvador de Bahia, Tremembé, or Nova Iguacú.

Thus, the national policies and regulations can be summarised as follows:

Based on current national and state legislations in Brazil, no landfill gas collection, flaring or any other treatment of the landfill gas is required.
It is unlikely that any legal requirements in regard to collection and flaring / energetic exploitation of the landfill gas would evolve in the medium-term.

[1] Source: First Brazilian Inventory of Anthropogenic Greenhouse Gas Emissions – Background Reports, Ministry of Science, June 2002.

[2] Source: Letter of the Brazilian Association of Residual Treatment Facilities to SAS, Annex 3 to Tremembé PDD, July 10, 2003 http://cdm.unfccc.int/EB/Panels/meth/CallForInputs/NM0021/NM0021_Annex3_Aberte.pdf

Baseline and additionality of the project

In the complete absence of any legal requirements and any commercial incentives in respect to LFG flaring or using LFG for energetic purposes, the common practice of operating landfills with passive venting and minimal flaring, i.e. occasional, manual ignition of the vented gas, is considered the most plausible scenario, and therefore the baseline.

The additionality of the project was demonstrated by conducting an investment analysis, based on an approved baseline methodology (see chapter B). Since - in absence of the CDM - the project is not the most economic course of action, it is reasonable to conclude that the emission reductions claimed in chapter B.4 below would not have happened in the absence of the project; therefore the project is considered additional.

Emission reductions

There are two components of emission reductions accruing from the project activity:

1. ***LFG recovery and flaring:*** By converting the LFG's methane (content 50%), a 21-times stronger greenhouse gas than carbon-dioxide, through combustion into CO_2, a significant reduction of greenhouse gases is achieved, e.g. with every 1'000 m^3 LFG which are captured and combusted, green houses gases equivalent to approx. 7 tons of CO_2 are not released to the atmosphere.
2. ***Generation and supply of electricity:*** With every MWh of electricity produced from LFG combustion in a engine/generator set and which is and fed into the Brazilian power grid, a certain amount of CO_2-intensive fuels used for power generation is substituted. For example, with every 1'000 m^3 of LFG converted in a gas engine into electric power, approx. 1 ton of CO_2, otherwise released by a modern fossil fuelled power plant, is replaced.

Although the project plans to implement the second activity as well, it is not the intention of the project company to claim emission reductions from the electricity generated and supplied to the grid. This contributes to conservatism in claiming CERs from the project activity.

A.4.5 Public funding of the project activity

No public funding is involved in this project.

B Baseline methodology

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

Simplified Financial Analysis for Landfill Gas Capture Projects (AM0003)

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

The applied methodology (AM0003) is applicable to landfill gas capture project activities where:

- The captured gas is flared; or
- The captured gas is used to generate electricity, but no emission reductions are claimed for displacing or avoiding electricity generation by other sources.

Both cases are applicable to the LARA landfill gas to energy project. During phase 1 (as described in A.4.3) the captured gas will be flared, while during phase 2 the captured gas is used to generate electricity, but no emission reductions are claimed for displacing or avoiding electricity generation by other sources.

This methodology is applicable only where the only plausible outcomes are a business-as-usual scenario (with minor changes and modifications) and the proposed project. The analysis in section B.3 below shows this to be the case for the LARA landfill gas to energy project.

A further justification for the choice of this methodology is the fact that this methodology has been developed and was applied in the context of a landfill gas to energy project in Brazil which is very similar to this project in regard to the legal framework, business environment, type, scope, size and timing of the project.

In conclusion, the conditions for the use of the AM0003 methodology are met.

B.3 Description of how the methodology is applied in the context of the project activity

The methodology selected comprises seven steps, which lead to an accurate determination of the most likely baseline scenario, as follows [3]:

[3] The wording of these those steps is based on **"**NM0005 Nova Gerar landfill gas to energy project PDD", Annex 3 (page 39) (http://cdm.unfccc.int/methodologies/UserManagement/FileStorage/FS_917639508), since at the time of writing this report, the corresponding methodology, although approved by the CDM EB on its meeting of Oct. 16/17 2003, has not yet been published officially on the UNFCCC website (http://cdm.unfccc.int/methodologies/approved).

Step 1: Draw up a list of possible baseline scenario alternatives

Following possible and plausible baseline scenarios are considered:

1. ***No investment scenario (continuation of existing situation):*** Lara, the landfill owner, would continue to operate the landfill as in the past, i.e. to deposit waste until the planned closure of the landfill in 2010, without installing any landfill gas (LFG) collection and flaring equipment. In order to avoid fire hazards, a few additional venting pipes would be installed, as have been in the past. The vented gas then would be occasionally flared by manually igniting the gas. The amount of gas estimated to be flared this way would be in the same range as today, e.g. 5 to 10% of the total gas produced by the landfill.
2. ***Installation of LFG collection and flaring system, but without energetic use:*** Lara would install a partial or comprehensive LFG collection and flaring system, however, without making use of the LFG for energy production (heat/and or power).
3. ***Installation of LFG collection/flaring system, with power generation (the project):*** This scenario represents the project, where a comprehensive LFG collection/flaring system will be installed within approx. one year (phase 1) and where the major portion of the collected LFG will subsequently be used for power generation (phase 2).
4. ***Installation of LFG collection and flaring system, with energetic use in other forms than power generation:*** Lara would invest in a comprehensive LFG collection/flaring system, but instead of using the LFG for power generation, produce alternative energy forms, e.g. heat for process steam or absorption cooling applications, or fuel gas for road vehicles (e.g. for its own refuse trucks).

Step 2: If justified, through elimination reduce the list of possible baseline scenario alternatives to the business as usual (BAU) scenario[4] and the proposed project alternative. Always provide convincing justification for the elimination of an alternative. For instance, a possible alternative is not plausible if it is not permissible under applicable law.

In regard to the baseline scenarios described above, the major barriers, which may prevent the scenarios from happening, are identified and assessed as follows:

Baseline scenarios		**Main Barriers**
Nr. 1	No investment scenario (continuation of existing situation)	***No barriers*** apply for this scenario, since this scenario reflects the current situation. No changes of the business environment are envisaged, in particular in regard to environmental legislation. Reminder: Current legislation in Brazil does not require LFG flaring.

[4] BAU is understood to mean the continuation of key present policies and practices. If BAU is conceived of as a set of concentric circles, this implies that no changes are expected to take place at the “core” – the “core” is constituted by the key present practices and policies. Changes at the “periphery”, however, may likely happen over time, as for instance due to minor regulations and policy adjustments. But such minor changes will not have any impact on the “core” which therefore will remain intact and unchanged.

Baseline scenarios		Main Barriers
Nr. 2	Installation of LFG collection and flaring system, but without energetic use	The ***main barrier is of financial nature***, since there are simply no revenues from this relatively high investment. The landfill operator would have to raise the tipping fee in order to make this scenario commercially feasibly, which will not be accepted by the municipalities.
Nr. 3	Installation of LFG collection/flaring system, with power generation (the project)	The ***main barrier is of financial nature***, since the revenues from power sales do not outweigh the high investment (in absence of the CDM), i.e. the project's IRR is significantly below market expectations, and thus not capable to attract investors (see chapters further below).
Nr. 4	Installation of LFG collection and flaring system, with energetic use in other forms than power generation	The ***main barrier is of financial nature***, since the project's IRR is expected to be even weaker than in scenario 3, mainly due to following reasons: - *Heat off-take:* No significant off-takers for heat (or cooling) energy are within reasonable distance, thus energy deliveries are economically unattractive. - *Fuel production:* "Standard "LFG-to-fuel" technology is not yet commercially available and economically viable, in particular the LFG enrichment/cleaning technology bears significant technical risks.

As a conclusion, only scenario 1 (no-investment scenario) is a plausible baseline scenario, beside the project itself. Therefore, in the following steps, it has to be demonstrated, that the project is additional, i.e. not the baseline.

Step 3: Calculate a conservative IRR for the proposed project activity not taking carbon finance into account. The calculation must include the incremental investment cost, the operation and maintenance costs, and all other costs of upgrading the BAU scenario to the proposed project activity. It must include all revenues generated by the project activity except carbon revenues. An IRR is calculated conservatively if the assumptions made tend to raise the IRR of the project scenario instead of lowering it. To ensure this, values that tend to lead to a higher IRR should be used for all assumptions. Conservatism of theses assumptions should be ensured by obtaining expert opinions and by the Operational Entity validating the project.

Electricity sector and liberalisation trends in Brazil [5]

Nearly 90% of Brazil's electricity production (installed capacity currently approx. 73'000 MW, consumption approx. 330'000 MWh/a) is based on hydro power plants, with the remaining 10% based mainly on conventional thermal generation incl. two nuclear power plants.

Although generation remains mostly under government control and transmission is not slated for privatisation in the near term, distribution is mostly in private hands. Regulatory difficulties have

[5] Sources: (1) Trade Guide on renewable Energy in Brazil, Winrock International Brazil, October 2002 (http://www.winrock.org/GENERAL/Publications/TradeGuide2002.pdf), (2) EIA country analysis briefs, July 2003 (http://www.eia.doe.gov/emeu/cabs/brazil.html)

been blamed for the lack of international interest in Brazilian electricity distribution. New regulations in February and July 2002 aimed to address these problems and boost investment.

After two laws restructured in 1995 the industry and laid the groundwork for private investment, the process stalled in the wake of the country's 1999 currency devaluation. An estimated 80% of Brazilian electric generation remains in public hands. As part of the privatization program, three remaining major federally owned utilities, Eletronorte, Furnas Centrais Eletricas (Furnas) and the Companhia Hidroeletrica do Sao Francisco (Chesf), have been split into several smaller generating and distributing utilities. However, additional privatization of these companies has been ruled out by the Lula administration. Federal utility Eletrobrás controls about half of the country's installed capacity and most of the large transmission lines. Eletrobrás coordinates and supervises the expansion and operation of the generation, transmission and distribution systems. Private capital flows resulting from privatisation had been expected to play a key role in bolstering the industry, especially as state-owned generators have not had investment capital available.

Legislation for small power producers

A combination of factors including draughts, increased demand and deferral of investment in renewal and expansion of generation infrastructure threw Brazil in 2001 in its worst energy crisis since several decades. In response to this severe power shortage, the Emergency Power Program and the Strategic Program for Expansion of the Power Supply was created with the objective to increase the national supply security and diversify Brazil’s electric energy supply. The main focus of the latter program, was to construct hydro- and thermoelectric plants, transmission lines and substations with investments in the range of R$ 43 billion in the period 2001 to 2004.

As part of this plan, alternative energy sources (wind, biomass, mini-hydro, CHP, etc.) are expected to more than double, i.e. from an installed capacity of 2’300 MW in 2001 to 5’600 MW in 2004.

In this context, the electricity law was modified in 2002 (New Electrical Sector Act, Law n. 10.438/2002) having the following major impacts on the renewable energy (RE) sector:

- Creation of the Program for *Incentive of Alternative Electric Energy Sources (PROINFA)* with the objective to stimulate RE generation through Autonomous Independent Producers (PIA). Wind, biomass and mini-hydro PIAs may enter into 15 years contracts with Eletrobràs, i.e. Brazilian Electrical Generators (the national holding company).
- Creation of the Energy Development Account (CDE), aimed at encouraging Brazils own energy resources, including RE, gas and national coal. The CDE was established to last for 25 years, is managed by Eletrobràs and is funded by levies on the use of public facilities, levies raised by the electricity regulator ANEEL and taxes on the commercialisation of energy.
- Tariff reductions of at least 50% for access to transmission and distribution systems for companies producing electricity from wind, biomass and qualified cogeneration systems.

- Allowance to directly commercialise electricity from RE sources with consumers exceeding 50 kW (for isolated systems)
- Assignment of economic values to the RE to be purchased by Eletrobràs by the Government. Those reference prices shall be specified for each energy technology and energy source. ***The bottom value of this "buy-back rate" however is 80% of the National End-User Average Tariff***. Those economic values are yet to be established, but – as an example - the National End-User Average Tariff is displayed in the following table.

Consumption Category	North	Northeast	Southeast	South	Mid-West	Brazil
Residential	184.46	179.03	213.18	202.55	195.08	203.44
Industrial	52.70	71.09	98.77	98.78	99.16	90.89
Commercial	167.46	158.25	188.71	169.63	178.29	179.66
Rural	126.34	102.77	122.34	99.59	122.35	109.42
Public Authorities	172.26	166.88	181.10	174.58	186.52	177.18
Public Lighting	107.74	100.40	116.98	102.84	104.55	109.30
Public Service	107.00	95.06	101.82	107.30	97.12	101.26
Self Consumption	164.36	167.65	83.02	83.56	194.36	[illegible]
Total Average Tariff	107.66	115.38	146.32	138.14	155.13	138.18

Table 2: Average tariffs by consumption category – Regional and National – from January to April 2002 (without ICMS), in R$/MWh (Source: ANEEL)

In summary, the privatisation of the electricity market in Brazil has not yet advanced to such a stage that the investments risks for small electricity producers are mitigated to a sufficient level, i.e. by providing clearly defined buy-back rates, utility obligations to conclude long-term power off-take contracts, etc.

The fact that, currently, there is no single landfill gas to energy system operating in Brazil underlines this situation and the risks perceived by investors.

Calculation of the project IRR

The total investments (phases 1 and 2) to be spent in the years 2004 to 2006 amounts to 14'000'000 US$. This includes the implementation of the complete gas collection and flaring system and installation of 10 MW_{el} power gas engines/power generator sets. O&M costs for all systems are expected to be in the range of 450'000 US$/a, representing 3.2 % of the total investment.

Assuming a net sales price of 36.80 US$/MWh (110.40 BRL/MWh, exchange rate 1 US$ = 3.00 BRL) for the electricity exported to the grid in the period starting from 2006 until 2025 (amounting to slightly more than 1'000'000 MWh in total over the whole period), a project IRR of 10.4% results. If the net sales price could be raised e.g. to 45 US$/MWh, the IRR would increase to

15.6%. However, net power sales prices of above 45 US$/MWh (135 BRL/MWh) are rather implausible.

Step 4: Determine whether the project IRR is clearly and significantly lower than a conservatively (i.e. rather low) expected and acceptable IRR for an alternative to this project or a comparable project type in the relevant country. This can be determined by comparing the IRR to relevant comparators. These can include:
- Government bond rates
- Expert views on expected IRRs for this or comparable project type
- other hurdle rates that can be applied for the country or sector

The IRR as explained above is significantly lower in comparison to:

- Government bond rates with currently 22% interest rate
- Average commercial lending rates of > 19% interest rate [6]
- IRR expectations of > 25% of commercial investors in renewable energy projects or industrial investors using similar technologies (e.g. gas engines) and having similar technical and commercial risks (yet excluding the Kyoto risks!)

Step 5: If the project IRR is clearly and significantly lower than a conservatively acceptable IRR, conclude that the project is not an economically attractive course of action and that therefore the BAU alternative is the most economically attractive course of action and the most likely baseline scenario.

As a consequence, the project is not an economically attractive course of action. As demonstrated above, the BAU scenario is therefore the only course of action, therefore representing the baseline scenario.

Step 6: Analyse and describe the anticipated development of the most likely baseline scenario during the crediting period.

The major factors determining the baseline are:

1. Development of landfill regulations, in particular of LFG collection/flaring requirements

[6] Lending rates are pegged to the central bank's overnight rate target, which is now at 19 percent (http://quote.bloomberg.com/apps/news?pid=10000086&sid=aIhMPdA9YUZk&refer=latin_america, on December 18, 2003)

2. Economics of landfill gas utilisation, which are influenced in particular by the development of the power market (legal framework) and electricity sales prices

In regard to the first aspect, current Brazilian legislation does not require LFG collection and flaring. As for the future, it is unlikely that such legislation might be introduced in the near future. This assessment is substantiated by a recent statement of the Brazilian Association of Residue Treatment Facilities (ABETRE) [7], stating, that "ABETRE does not believe that legislation concerning this matter will change in the next 10 years since, today, sites for urban waste disposal that treat and recover biogas are rare (less than 10 facilities). The majority of landfills is not prepared to do it and a great part of them still needs to solve more urgent environmental problems (water contamination by leachate, exposed waste, etc.)".

As for the power market, it was described above that in the context of the modification of the electricity law in 2002, the assignment of economic values to renewable energy to be purchased by Eletrobràs has been foreseen by the Government but has not be introduced yet. Once this concept has been implemented, it is expected, as described, that the value of this "buy-back rate" will not significantly exceed the proposed 80% levels of the National End-User Average Tariff, at least in a first "trial period" which might last several years alone.

Step 7: Provide a summary description of the baseline scenario.

The baseline is defined as the continuation of the existing situation, i.e. the landfill owner will not take any particular action to prevent LFG emissions, apart from occasionally and manually igniting gas emanating from the small number of passive vents currently installed for reducing the risk of accidental fires.

B.4 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

As outlined earlier, the project activity involves investments in an active gas collection system, improvements of the leachate drainage and landfill covering system and the installation of electricity generation and gas flaring plants.

The baseline has been identified as the continuation of the current situation. Thus, as a consequence, GHG emissions are reduced two-fold:

1. ***LFG recovery/flaring:*** By converting the LFG (being released to the atmosphere in the baseline) through means of combustion (i.e. flaring and power generation) into CO_2.

[7] The letter was issued by ABETRE on July 10, 2003, to SASA Sistemas Ambientais Comércio Ltda, see Annex 7 of CERUPT methodology for landfill gas recovery (NM0021), http://cdm.unfccc.int/methodologies/process?cases=B

2. ***Generation and supply of electricity:*** With every MWh of electricity produced from LFG combustion in a engine/generator set and fed into the Brazilian power grid, a certain amount of CO_2-intensive fuels used for power generation is substituted. *However, for the purpose of conservatism, these emission reductions are not accounted in the project.*

In section B.3 above it was demonstrated by means of an investment analysis, that the project is not the baseline, therefore, the project is additional.

B.5 Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity

In application of the selected baseline methodology, the ***project boundary*** covers the whole geographic area of the Lara landfill site incl. the (future) power production facilities.

The ***GHG sources considered*** involve direct on-site emissions, i.e. landfill gas released to the atmosphere in baseline and project scenario.

GHG sources excluded – because they are not under the control of, insignificant or not attributable to the project activity, are:

- ***Indirect on-site emissions:*** landfill operation equipment, electricity used to operate the project, emissions from construction of the project
- ***Direct off-site emissions:*** Transport of equipment and construction materials, emissions associated with the electricity generated
- ***Indirect off-site emissions:*** Transport of waste to the landfill

B.6 Details of baseline development

B.6.1 Date of completing the final draft of this baseline section (DD/MM/YYYY)

18/12/ 2003

B.6.2 Name of person/entity determining the baseline

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C Duration of the project activity / Crediting period

C.1 Duration of the project activity

C.1.1 Starting date of the project activity

Expected starting dates are as follows:

Start of construction phase 1:	month / year	08 / 2004
Start of construction phase 2:	month / year	07 / 2005
Commissioning	month / year	11/ 2004
Start of CER generation	month / year	01/2005

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 (at most seven (7) years per period)

Starting date of the first crediting period (DD/MM/YYYY)

01/01/2005

Length of the first crediting period (in years and months)

7 years

D Monitoring methodology and plan

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

Simplified Financial Analysis for Landfill Gas Capture Projects (AM0003) [8]

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

A typical characteristic of LFG to energy projects is that the emissions not released to the atmosphere can directly be monitored, i.e. baseline emissions are not to be known and therefore no monitoring of the baseline emissions are required.

Thus, the methodology utilises direct monitoring of the emission reductions from the project activity. The emission reductions due to the project activity are monitored and calculated as differentials, in a two-step methodology taking into account methane combustion in electricity generation and methane combustion in flares.

The total emission reductions are the summation of results of step 1 (methane combustion in power generators) and step 2 (methane combustion in flares). The sum is discounted by an Effectiveness Adjustment Factor, i.e. an appropriate factor to reflect the level of flaring that would occur if the project adopted the gas collection system requested by regulatory agencies in the inception of the project. The Effectiveness Adjustment Factor will need to be revised at the end of every baseline crediting period (e.g. for the first time after 7 years), by estimating the amount of GHG flaring taking place as part of common industry practices at that point in the future[9].

In line with the approved methodology, the Effectiveness Adjustment Factor is set to 20% as default for the first 7-year crediting period.

The methodology is applicable to all landfill gas project activities globally which are not claiming credits for their electricity production

[8] This section is based on **"**NM0005-rev Nova Gerar landfill gas to energy project PDD", Annex 4 ((http://cdm.unfccc.int/methodologies/UserManagement/FileStorage/FS_274031754), since at the time of writing this report, the corresponding methodology, although approved by the CDM EB on its meeting of Oct. 16/17 2003, has not yet been published officially on the UNFCCC website (http://cdm.unfccc.int/methodologies/approved).

[9] This shall be done by an expert assessment considering the percentage of gas being flared at other landfills in the country, in relation to the potential gas collected by state-of-the-art installations (control group approach)

D.3 Data to be collected in order to monitor emissions from the project activity, and how this data will be archived

ID	Data variable	Data unit	Measured, Calculated, or Estimated	Recording frequency	Proportion of data to be monitored	How will data be archived?	For how long is archived data to be kept?	Comment
1	Flow of landfill gas to flares	m^3	M	Continuous	100%	Electronic (spreadsheet)	Until end of crediting period + 4 years (25 years)	Data will be aggregated monthly and yearly (Additionally, gas temperature and pressure will be monitored at different points of the system)
2	Gross electricity production	MWh	M	Continuous	100%	Electronic (spreadsheet)	Until end of crediting period + 4 years (25 years)	Data will be aggregated monthly and yearly
3	Generator heat rate	GJ/MWh	M & C	Semi-annual verification of validity of generator plate rating (if significant variation since last monitoring, monitoring repeated every month)	Semi-annually or more frequently depending on observed deviations from previous rating	Electronic (spreadsheet)	Until end of crediting period + 4 years (25 years)	Data will be used to test and, if necessary, correct the generators' standard heat rate plate ratings
4	Flare efficiency	%	M & C	Semi-annual determination of flare efficiency (if significant variation since last monitoring, monitoring repeated every month)	Semi-annually or more frequently depending on observed deviations from previous rating	Electronic (spreadsheet)	Until end of crediting period + 4 years (25 years)	Data will be used to test and, if necessary, correct the flares' efficiency ratings
5	Methane fraction in LFG	%	M % C	Continuous	100%	Electronic (spreadsheet)	Until end of crediting period + 4 years (25 years)	Data will be aggregated monthly and yearly
6	Electricity for gas and leachate pumping	kWh	M	Continuous	100%	Electronic (spreadsheet)	Until end of crediting period + 4 years (25 years)	Electricity will be produced with landfill gas (own generation)

D.4 Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources

None

D.5 Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

ID 6: Assessment of Effectiveness Adjustment Factor

After 7 and 14 years (i.e. towards the end of the first and second 7-years crediting period), a survey of at least 10 other landfills in the country shall be conducted by an expert (e.g. from the Brazilian Association of Residue Treatment Facilities, ABETRE) to determine the percentage of landfill gas flaring (with relation to the total achievable amount) that these companies do in their sites in the absence of carbon finance incentives. This percentage (called the “Effectiveness Adjustment Factor”) will be used to reduce the amount of emission reductions claimed by the project in the following crediting period.

Although the approved methodology outlines already some of the items the expert will need to estimate, we suggest, that at the time when the first baseline revision is due (e.g. approx. 7 years from now on) the actual procedure or methodology agreed on by the relevant authorities shall be followed. Similar, the control group shall be defined at that point in the future.

ID 7: Assessment of electricity generation becoming an attractive course of action

After 7 and 14 years (i.e. towards the end of the first and second 7-years crediting period), a survey shall conducted by an expert (e.g. from the Brazilian Association of Residue Treatment Facilities, ABETRE) to determine whether electricity generation based on captured landfill gas has become the most attractive course of action.

D.6 Quality control (QC) and quality assurance (QA) procedures that are being undertaken for data monitored

Data ID	Uncertainty level (High/Medium/Low)	Are QA/QC procedures planed for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D.3-1	Low	YES	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
D.3-2	Low	YES	Meters will be subject to a regular maintenance and testing regime to ensure accuracy. Their readings will be double-checked by the electricity distribution company.
D.3-3	Low	YES	Regular maintenance will ensure optimal operation of engines and generators. The heat rate used for calculating ERs will be checked annually or more often if significant deviations from standard or previously used heat rate is observed.
D.3-4	Low	YES	Regular maintenance will ensure optimal operation of engines and generators. Flare efficiency will be calibrated annually or more often if significant deviations from previous efficiency ratings are observed
D.3-5	Low	YES	Gas analyser will be subject to a regular maintenance and testing regime to ensure accuracy

All data that are to be monitored (as defined under D.3) have to undergo an internal semi-annual review. During this review the records are checked by two internal persons that are not involved in the actual data recording. The two reviewers a) double-check the quality of the data recorded and b) audit the GHG project compliance with operational requirements. If they identify a need for corrective actions they propose the same to the management of LARA Energia. The reviewers summarize their findings in written form. The semi-annual review is scheduled in a way that one of the reviews is always carried out within 30 days before the data will be submitted for independent validation.

Please not that LARA was certified in 2000 by BVQI with the ISO 9002.

D.7 Name of person/entity determining the monitoring methodology

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E Calculation of GHG emissions by sources

E.1 Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary

Not applicable, because emission reductions are directly calculated (refer to chapter E.5).

The only source of project emissions identified within the system boundary is fugitive methane emissions from the landfill. It has been assumed that the gas collection system installed will collect approx. 75% of the total amount of gas produced by the landfill.

E.2 Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity

Leakage needs not to be considered.

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

Not applicable, because emission reductions are directly calculated (refer to chapter E.5).

E.4 Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline

Not applicable, because emission reductions are directly calculated (refer to chapter E.5).

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

The emission reductions are directly monitored and calculated, using the two-step approach of the approved methodology, as follows:

Step 1: Methane combustion in electricity generators:

- Calculation of total energy input E_{in} [GJ/a] = Electricity produced El_{out} [MWh/a] **x** Generator heat rate HR [GJ/MWh]
- Conversion of total energy input E_{in} into tons of CH_4, using default values for the calorific value $CV_{methane}$ (0.0357 GJ/m^3) and density of methane $D_{methane}$ (0.0006498 t CH_4 / m^3 CH_4).
- Multiplying with the global warming potential of methane $GWP_{methane}$ [21 t CO_2 / t CH_4] the annual emissions $Emissions_{el.gen.}$ [CO_{2e}/a] displaced by the project through methane combustion to generate electricity results.

In one formula:

(1) $Emissions_{el.generation}$ [t CO_{2e}/a]= $$\frac{GWP_{methane} * EL_{out} * HR * D_{methane}}{CV_{methane}}$$

Step 2: Methane combustion in flares:

- The volume of methane combusted in flares $Methane_{flared}$ [m^3/a] is the volume of LFG channelled to flares LFG_{flares} [m^3/a] multiplied with the methane fraction in landfill gas $F_{methane}$ [%] multiplied with the efficiency of the flares EF [%]
- The volume of methane combusted is then converted into tons of CO_{2e} by multiplication with the density $D_{methane}$ (0.0006498 t CH_4 / m^3 CH_4) and the global warming potential of methane $GWP_{methane}$ [21 t CO_2 / t CH_4]

In one formula:

(2) $Emissions_{flaring}$ [t CO_{2e}/a]= $LFG_{flares} * F_{methane} * EF * D_{methane} * GWP_{methane}$

Total CER generated by the project are then the results of step 1 plus step 2 discounted by the Effectiveness Adjustment Factor (EAF, by default 20%):

(3) CER [t CO_{2e}/a] = ($Emissions_{el.generation}$ + $Emissions_{flaring}$) x (1 – EAF)

E.6 Table providing values obtained when applying formulae above

The following table summarises the estimates for baseline and project emissions, the resulting emission reductions (without effectiveness adjustment) and the expected creditable emission reductions taking into account the 20% Effectiveness Adjustment Factor (EAF).

GHG Emisson (estimates)	Baseline	Project	ER w/o EAF	net ER
1st crediting period (years 2005 - 2011)	7.222.019	1.805.505	5.416.514	4.333.211
2nd crediting period (years 2012 - 2018)	6.720.841	1.680.210	5.040.631	4.032.505
3rd crediting period (years 2019 - 2025)	3.528.671	882.168	2.646.503	2.117.202
Total	17.471.530	4.367.883	13.103.648	10.482.918
1st Kyoto commitment period (years 2008 - 2012)	5.298.034	1.324.509	3.973.526	3.178.820

EAF: Effectiveness Adjustment Factor (20%)

As mentioned, these figures are estimates based on the EPA first order decay model, where various parameters had to be assumed. Hence, the emission reductions obtained in reality (through monitoring the project emissions) may differ form those estimates.

F Environmental impacts

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

To obtain the environmental license, new landfills or site expansions need a Environmental Impact Assessment (EIA-RIMA by Brazilian law). The EIA was conducted 1991 by the specialized engineering company KMG.

For the implementation of the landfill gas collecting system no further EIA is necessary (Appendix 3, Letter of CETESB).

For the energy generation system a simple project design document is required by CETESB, given the power capacity is below 10 MW. This will be done until the end of 2004.

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

Landfill gas electricity generators produce nitrogen oxides emissions that vary widely from one site to another, depending on the type of generator and the extent to which steps have been taken to minimise such emissions. Combustion of landfill gas can also result in the release of organic compounds and trace amounts of toxic materials, including mercury and dioxins, although such releases are at levels significantly lower than if the landfill gas is flared. These emissions are also viewed as significantly less harmful than the continued uncontrolled release of landfill gas.

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

Groundwater and surface water can be contaminated by untreated leachate from landfill sites. Leachate may cause serious water pollution if not properly managed. Surface water run-off

from a landfill site can also cause unacceptable sediment loads in receiving waters, while uncontrolled surface water run-on can lead to excessive generation of leachate and migration of contaminated waters off-site. With LARA Energia improving appropriate management on the site, these problems will be reduced.

Unlike other power plants that rely upon water for cooling, landfill gas power plants are usually very small, and therefore pollution discharges into local lakes or streams are typically quite small.

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

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

- Noise - There will be some increase in noise from the site associated with energy recovery, although the engines will be housed to reduce noise emissions. The impacts are likely to be marginal given the noise typically associated with operations at the landfill.

- Visual amenity - Placement of energy recovery facilities at the landfill site will increase the visual presence of the site, however the impacts are expected to be marginal given the visual intrusion currently associated with the waste disposal operations.

The landfill gas utilisation scheme of LARA Energia promotes in parallel best practices to improve landfill management standards, and contributes towards a global sustainable development.

F.2 If impacts are considered significant by the project participants or the host Party:

No significant negative impacts to the environment will result from the project activity. On the contrary the following environmental benefits will result in:

• Significant reduction of methane emission
• Generation of green energy
• Reduction of toxic gas emission (like CO, NO2, SO2, H2S, etc.)g
• Improvement of landfill cover, reducing leachate generation
• Leachate pumping, reducing risk of groundwater pollution
• Reduction of nuisance odour

G Stakeholders comments

The project company acknowledges the importance of sound corporate governance and a transparent information policy, and thus pays great attention to healthy relations with all stakeholders involved. To foster the project's acceptance, the various local stakeholders have been informed on all details of the project on different occasions. Stakeholders were invited to submit their comments or ideas regarding the project and its design at any time, or raise their concerns at any of the special information events to be held by the project company (dates and venues of such events were announced through the media or by direct invitation letter). Any comments and the results of discussions have been reported, summarised and published, and were considered by the project company during the further development of the project.

G.1 Brief description of the process on how comments by local stakeholders have been invited and compiled

Stakeholders addressed

Based on the resolution No1.[10] of the Brazilian Designate National Authority represented by the Interministerial Commission on Climate Change (Comissão Interministerial de Mudança Global do Clima), the following entities are to be addressed in the course of the stakeholder process:

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

[10] http://www.mct.gov.br/clima/comunic/resolu2.htm

In line with this resolution, the following stakeholders have been addressed in the period of October and November 2003:

Institution / entity	Name of contact person
ALTRAN / POLEN	Rodrigo Gonçalves Pires
Assessora Legislativa	Silvana Lages
Associação UAB	Sidinei A. A. Júnior
Aterro Boa Hora	Júlio Gurgel
Colégio Barão de Mauá	Giovanna
Câmara Municipal de Mauá	Paulo Sérgio Pereira
Câmara Municipal de Mauá	Suzana Lages
Câmara Municipal de Mauá	Manoel Lopes
Câmara Municipal de Mauá	Rogério Santana
Câmara Municipal de Mauá	Ricardo Llaques
Câmara Municipal de Mauá	Luiz Grigio
Câmara Municipal de Mauá	Paulo Bio
Câmara Municipal de Mauá	Claudete Porto
Câmara Municipal de Mauá	Teka
CENBIO / USP	Vanessa Pecora
CENBIO / USP	Américo Varkuslya Júnior
CETESB	Flávio Yamamoto
CETESB	Joao Wagner
CETESB	Ana Carla Rodero
CETESB	Eduardo Cardoso
DER	Gilda Roseli Napoleão
DER	Leda Maria Delambro
DER	Marlene Pinto Ceccon
Diario do Grande ABC	Lione Farias
Diario do Grande ABC	Mario Barbosa
DNV	Cândido Capoy
Ecco Press	Paula Pierri
EM Peter Pan	José A. Soares Cruz
Factor Ag.	Christoph Sutter

FAMA - Faculdade Mauá	Cláudio Milânez
Hospital Brasil	Patricia A. Martins
LARA	Francisco Molnar
LARA	Renato Damo
LARA	Delmo Alves
MCT	Newton Paciornik
MCT	José Domingos Gonzales Miguez
PART	Rodrigo S. Gozalez
Portadores de deficiência	José de Souza
Prefeitura Municipal de Mauá	Eliésio F. Silva
Prefeitura Municipal de Mauá	Ronaldo V. Pereira
Prefeitura Municipal de Mauá	Oswaldo Dias
Prefeitura Municipal de Mauá	Antonio P. Loreto
Prefeitura Municipal de Mauá	Geraldo Vieira
Prefeitura Municipal de Mauá – SMDES	Reinaldo M. Mussini
Prefeitura Municipal de Ribeirão Pires	Marcio Vale
Prefeitura Municipal Rio Grande da Serra	Luiz Carlos Ramos
Revista Livre Mercado	Fabiano
Rodrigo Lex	Karina G. Martins
Revista Saneamento Ambiental	Paulo Antunes
SANPPER	Renato Sanches Pinheiro
SEMASA	Iracegis M. dos Santos
SEMASA	Pedro H. Milani
SEMASA	Marcelo Bispo
UBS Vila Carlina	Idinéia Ferreira
UBS Vila Carlina	Joana de Fátima Rodrigues
UBS Vila Carlina	Adriana Alves dos Santos
VALIN	Luiz Fernando Adelto
AEPIS	Roseli Maria Biason Mussini
Associação de bairro dos moradores da Vila Assis	Sidney
CAMBRAS TVA	Beto Bedokerr
DAIA	Pedro José Stech

DEPRN ABC	Ademir Celso Menegueti
DEPRN SP	Roberto Guimarães Mafra
Diretoria de Ensino da Região de Mauá	Marilene Pinto Seccon
Escola Estadual Marilene de Camargo Acetto	Jane Donattielo de Campos
FIESP	Horácio Lafer Piva
FNMA	Raimunda Nonata Monteiro da Silva
IPT	Guilherme Ary Plonsky
Jornal Folha de São Paulo	Otavio Frias Filho
Jornal O Estado de São Paulo	Luiz Octavio Lima
MMA	Maria Osmarina da Silva Vaz de Lima
NEA-ABC	Cleyde Angelica Ferreira da Silva Chiregatto
Prefeitura do Município de Diadema	José de Filippi Jr
Prefeitura do Município de Praia Grande	Alberto Pereira Mourão
Prefeitura do Município de Rio Grande da Serra	Ramon Alvaro Velasquez
Prefeitura do Município de Santo André	João Avaliemo
Prefeitura do Município de São Caetando do Sul	Luiz Olinto Tortorello
Prefeitura do Município de São Bernardo do Campo	Willian Dib
Prefeitura do Município de São Vicente	Marcio Luiz França Gomes
Revista Banas Qualidade	Fernando Banas
Revista Maio Ambiente Industrial	Julio Tocalino Neto
Escola Politécnica da USP	Vahan Agopyan
Núcleo de Educação Infanti Vila Carlina	José Antonio
Ministério Público Federal	Paula Bajer Fernandes Martins da Costa

Activities undertaken

The Stakeholder Consultation Process for the LARA Energia project included two workshops, in November 2003, targeting both the national and the local community.
All the stakeholders identified above got an invitation, per conventional mail and per e-mail. Some neighbours from the community of Vila Carlina were invited personally. This invitation, as showed in Appendix 1, included a first introduction to the project, and gave a telephone number and an e-mail address to collect comments.
During the workshops, the public were asked for their comments regarding the technical, environmental and social issues of the project.

Up to present date, all organizations agreed with the project concept and most of them emphasize the importance of renewable energy production and the mitigation of the global warming impacts

- Workshops:

November, 27th, 2003 – Santo André City Hall - All the stakeholders, including local and federal authorities, industry and university stakeholders, were invited to the hearing, which inform about technical aspects of the project, Kyoto Protocol basics, clean development mechanism, LARA landfill history and operational procedures, description of social programs and the role of government agencies in the project.

November, 28th, 2003 - LARA Landfill - The same hearing took place, this time inviting community and local school leaders.The focus of this hearing was less technical.

- Media Coverage:

TV:

- TV Globo - Jornal Nacional – Nov 1st, 2003 – 8:15pm - 2'43" long .

Newspaper:

- O Estado de S. Paulo - Economia – Oct 10th, 2003 - Nota na coluna da Sônia Racy "Do futuro"
- Diário do Grande ABC – Economia – Nov 28th 2003

Magazines:

- Revista Livre Mercado – Jan 4th, 2004 - pages 5, 88 and 89.
- Revista Banas Qualidade - ed. janeiro/04 - page 66.
- Revista Saneamento Ambiental – Nov/Dec issue, 2003 - page 52.
- Revista Energia e Mercado – Dec/Jan issue, 2004 - page 7.

G.2 Summary of the comments received

Lara Energia invited the stakeholders to submit comments. One comment was received.

Comment 1:
Initially, Lara Energia suggested to finance the instalment of a sewage water collecting system

at Vila Carlina. The municipality of Mauá told Lara to consider this as a duty of the municipality. The municipality of Mauá plans already to install a sewage water collecting system at Vila Carlina .

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

The only comment received concerned the social programme planned by Lara Energia (see comment 1 in section G.2). Following this comment the social programme was redesigned and the idea of financing a sewage water collecting system at Vila Carlina was dropped. As a substitution, leisure installations and leisure activities will be supported. Therefore, the comment could be taken fully into account.

Annex 1: Contact information on participants in the project activity

Organization:	Lara Co-Geração e Comércio de Energia Ltda
Street/P.O.Box:	Estrada de Guaraciaba, n° 1.985, Sala 2, Bairro Sertãozinho
Building:	
City:	Mauá
State/Region:	Sao Paulo
Postfix/ZIP:	CEP n. 09370-840
Country:	Brazil
Telephone:	+55 11 5094 04 94
FAX:	
E-Mail:	ralf.lattouf@laraenergia.com.br
URL:	www.laraenergia.com.br
Represented by:	
Title:	Project Manager
Salutation:	Mr.
Last Name:	LATTOUF
Middle Name:	
First Name:	Ralf
Department:	
Mobile:	
Direct fax:	
Direct phone:	+55 11 5094 04 94
Personal E-Mail:	ralf.lattouf@laraenergia.com.br

Annex 2: Information regarding public funding

No public funding is involved in this project.

Annex 5: Table: Baseline data

Inputs — **Note: Do not change any figures in this sheet !!!**

Project description and time schedule			
Short description of project:		Landfill gas (LFG) collection & flaring (phase 1) and power generation (phase 2)	
Planned proportion of LFG/methane collected:	%	75%	
Start of construction phase 1:	month / year	07 / 2004	
Start of construction phase 2:	month / year	07 / 2005	
Commissioning & start of CER generation:	month / year	01 / 2005	
Crediting time:	years	3 x 7	
Power generation			
Technology:		Gas engine / generator sets	
Average availability	%	90%	equivalent to 7.884 full load operation hours per year
Installed capacity phase 1 (max.):	MWel	1,0	(covering internal consumption)
Installed capacity phase 2 (max.):	MWel	10,0	(grid connected)
Project costs			
Investment costs phase 1:	US$	4.500.000	
Investment costs phase 2:	US$	9.500.000	
Total investment costs:	**US$**	**14.000.000**	
Average annual project operation costs:	US$/a	449.091	
Average annual costs for social activities:	US$/a	61.364	
Project revenues			
Average electricity sales price:	US$/MWh	36,80	i.e. 80% of National End-USER Average Tariff (2002: 138 R$/MWh)
Landfill data			
Landfill opening:	year	1987	
Landfill closure (planned):	year	2014	
Waste deposited until the end of 2003:	t	5.582.213	
Waste deposited from 2004 until closure (planned):	t	5.940.000	
Landfill gas (LFG) / Methane generation			
Methane generation constant k:	1 / a	0,1	
Methane generation potential L0:	m3 / t waste	160	
Methane content in LFG:	%	50%	
Calorific value of methane:	MJ / m3	35,7	
GWP of methane:	t CO2 / t CH4	21	
Density of methane:	kg / m3	0,6498	
Baseline			
Short description of baseline:		Continuation of existing situation (partial venting only)	
Effectiveness Adjustment Factor (EAF):	%	20%	

Outputs

GHG emissions (estimates)		**Baseline**	**Project**	**ER w/o EAF**	**net ER**
1st crediting period (years 2005 - 2011)	t CO2e	7.222.019	1.805.505	5.416.514	4.333.211
2nd crediting period (years 2012 - 2018)	t CO2e	6.720.841	1.680.210	5.040.631	4.032.505
3rd crediting period (years 2019 - 2025)	t CO2e	3.528.671	882.168	2.646.503	2.117.202
Total	**t CO2e**	**17.471.530**	**4.367.883**	**13.103.648**	**10.482.918**
1st Kyoto commitment period (years 2008 - 2012)	t CO2e	5.298.034	1.324.509	3.973.526	3.178.820

Power generation		
Generated electricity phase 1 (gross, cumulative):	MWh	7.884
Generated electricity phase 2 (gross, cumulative):	MWh	1.080.108
Project Internal Rate of Return		
IRR (excl. revenues from CER sales):	%	10,1%

Appendix 1: Invitation Stakeholder Consultation

Mauá, 06 de novembro de 2003

Seminário "Projeto LARA ENERGIA"

Prezados Senhores,

Temos a satisfação de convidá-lo(a) para o seminário de apresentação do projeto LARA Energia, a ser realizado no dia 27/11/03, no Consórcio das Prefeituras do ABC, situado na avenida Ramiro Colleoni nº 5, Santo André – SP.

Objetivo: apresentar à sociedade e aos envolvidos o projeto LARA ENERGIA, que consiste na captação do biogás do aterro LARA, para queima e geração de energia elétrica, bem como na implantação de um projeto MDL para a geração de créditos de carbono oriundos da destruição térmica do metano. O seminário tem ainda por objetivo ser um fórum para discussão e sugestão dos envolvidos, bem como esclarecer dúvidas dos mesmos relativas ao projeto.

Programa:

08:30 – 09:00 Registro de Participantes

09:00 – 09:30 Abertura e Introdução ao Conceito de MDL

Palestrante: Ralf Lattouf – ARQUIPÉLAGO Engenharia Ambiental
Teor: Apresentação da LARA ENERGIA e dos fundamentos do protocolo de Kyoto e do Mecanismos de Desenvolvimento Limpo – MDL

09:30 – 9:50 Aterro LARA
Palestrantes: Wagner Damo / Yara Almeida - Aterro LARA
Teor: Histórico das atividades do aterro LARA, aspectos ambientais e operacionais

9:50 – 10:20 Lara Energia - Aspectos Técnicos
Palestrante: René Büchler – ARQUIPÉLAGO Engenharia Ambiental
Teor: Explanação do sistema de captação de biogás, instrumentação, destruição térmica e co-geração de energia elétrica.

10:20 – 10:40 Lara Energia - Aspectos Sociais
Palestrante: Yara Almeida / Priscila Blocchi
Teor: Descrição de programas sociais para a comunidade próxima ao aterro LARA a serem implantados / fomentados.

10:40 – 11:00 Coffee - Break

11:00 – 11:30 Governo Brasileiro / MCT
Palestrante: A confirmar
Teor: Visão e participação do governo brasileiro em projetos MDL

11:30 – 12:00 Palestrante: João Wagner Alves – CETESB
Teor: Apresentação da visão do órgão ambiental do Estado de São Paulo, sobre projetos MDL e o aproveitamento do Biogás.

12:00 – 12:30 Prefeitura de Mauá
Palestrante: Dr. Oswaldo Dias - Prefeito de Mauá
Teor: A importância do projeto LARA Energia para o grande ABC e para o município de Mauá.

12:30 – 13:00 Abertura para dúvidas e discussão

Solicitamos o obséquio de confirmarem sua presença até 15/11/03 pelo: e-mail info@arquipelago.eng.br , fone (11) 5094-0494 ou fax (11) 5044-2055.

Sua participação é muito importante.

Cordialmente,

Ralf Lattouf

Appendix 2: Social Indicators

According Annex III of the Resolution 1 of September 11, 2003, by the Interministerial Commission on Global Climate Change, the project participants shall state whether and how the project activity will contribute to sustainable development, in regards to the following aspects:

1. Local environmental sustainability

The Lara landfill is already today a controlled landfill with restricted access, leachate collecting and treatment system and groundwater monitoring. As the landfill gas is not flared in an adequate way, the main impact is the emissions of greenhouse gases and other gases, many of which are toxic . There is also a certain risk of spontaneous explosion and fires. Due to poor landfill cover, leachate level in the waste mass tend to be high, being a considerable risk of groundwater pollution.

The mayor benefit of the gas to energy project is the reduction of about 500.000 tons of methane emission. The implementation of the project will also reduce the emission of toxic gases.

Improved landfill covering and leachate pumping reduces the amount of leachate and the risk of groundwater pollution.

Significant odour reduction and reduced fire hazard risk are other additional benefits.

The landfill gas utilization will produce a considerable quantity of renewable energy during more than 20 years.

2. Contribution to development of working conditions and net job creation

The emission reduction will improve directly the working condition for the people employed on the landfill. The additional income will help to extend and improve already implemented health and training programs for the staff.

During project implementation, jobs for about 20 to 30 workers will be created during a limited time, estimated by 6 – 12 months..

The operation of the system will create about 6 –10 long term jobs for qualified workers.

Direct investments (5% of net income from CERs sale) in social activity programs will create additional employment .

Through the support of a waste separation project, run by the municipality of Mauá, the number of scavengers employed will improve significantly.

3. Contribution to the distribution of income

Partnerships with an existing alphabetization program and training programs for young people in poor areas will help to improve their income.

The additional jobs created will benefit mainly the local community.

The low-income population will also benefit from increased tax income for the municipality of Mauá, based on the project company's operational results..

4. Contribution to training and technological development

State-of-the-art technology, successfully implemented worldwide, will be chosen for this project. Equipment will be partly imported. But most of the installation will be produced in Brazil under the supervision of international consultants. Local staff will be trained to operate the plant under experienced supervision. Afterwards, this technology can be reproduced in other similar projects throughout Brazil.

5. Contribution to the regional integration and linkages with other sectors

The project will be a positive example how to improve the landfill technology and take advantage of the possibilities created by the Clean Development Mechanism (CDM). The project will be promoted in the region as an example for other landfills.

To develop a project of such complexity, the integration of different sectors such as waste management, environmental engineering, legal consultancy, energy production and distribution, local government and social institutions representing the local community are necessary.

The development of his project will help to show the role and importance of all the involved sectors and will promote further implementation of CDM projects, contributing to sustainable development.

Monitoring and Recording of Sustainable Development

The MVP compares the project's actual environmental and development performance, as measured by the indicators below with the set target values and determines whether the targets have been reached or not. As long as the monitoring process shows that the project's performance meets these targets, the project is considered to be in compliance with its sustainable development objective, otherwise corrective actions will be taken.

Activities	Expected benefits	Monitoring
During project implantation		
Environment		
Building activity	Negative effect: temporary emission from building equipment's	No monitoring
Socio-economic		
Building activity	Job creation (20 - 30, for 6 -12 month)	Employment records
Operation Period		
Environment		
Leachate pumping	Lower leachate level in landfill, groundwater protection	Piezometer
Landfill cover	Leachate reduction	Flowmeter
Landfill cover	Odour reduction	Report of neighbors
Gas colleting and burning	Emission reduction	Air monitoring

Gas colleting and burning	Improved safety	Records of fire or accidents
Socio-economic		
Operation and monitoring	Job creation (6 - 10)	Employment records
Operation and monitoring	Incremental wages	
Gas colleting and burning	Improvement of working conditions	Annual health control
Additional Activity (investing 5% of CERs sale net income)		
Recycling program: Waste separation on the Lara Landfill	Create 10 - 20 fulltime jobs	Employment records
Environmental Education	Attending 500 - 1000 students and teachers a year	Register of participation
Adults alphabetisation programme	Attending 50 - 100 person a year	Register of participation
Partnership CAJUS Project	Attending 50 - 100 person a year	Register of activities and participation
Support of suburb Vila Carlina (aprox. 2´000 inhabitants)	Leisure installations, supporting activities	Register of activities and participation
Conference, symposium	Presentations in media, Technology transfer	Number of presentations register of participation

Appendix 3: Letter of CETESB

COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

CETESB

Á
LARA COMÉRCIO E PRESTAÇÃO DE SERVIÇOS LTDA.
Av. Guaraciaba, 430 – CEP.: 09370-840
Mauá – SP

A/C Sr. Wagner Damo

N/CÓD : CTi-N/536/04
DATA : 12.08.2004

ASSUNTO : CORRESPONDÊNCIA DE 06.07.04

Prezados Senhores,

Acusamos o recebimento da correspondência apresentada em 06.07.2004, por meio da qual é solicitada orientação quanto a necessidade de novo processo de licenciamento para a implementação de melhorias no sistema de drenagem, captação e queima dos gases produzidos em seu aterro sanitário e verificamos que conforme as informações prestadas o sistema proposto pretende substituir gradativamente os drenos existentes, construir novos, interliga-los através de dutos e conduzi-los por meio de tubulação a um único ponto de queima controlada.

Desta forma entendemos que, por se tratar de mudança de tecnologia em sistema já existente promovendo ganho ambiental na área do aterro, a implantação das melhorias, conforme proposta apresentada, prescinde de novo licenciamento.

Sendo o que nos apresentava para o momento, subscrevemo-nos.

Atenciosamente.

Engº Luiz Antonio Brun,
Reg. Nº 16-2623-0
Gerente da Agência Ambiental de Santo André

CETESB – Companhia de Tecnologia de Saneamento Ambiental – Agência Ambiental de Santo André - Av. Higienópolis, nº 177 – Vila Boa Vista – Santo André - SP– CEP.: 09190-360 - Tel.: (0xx11) 4994-8700 Fax: (0xx11) 4990-5803 - C.N.P.J. n.° 43776491/0016-56 – Insc. Est. n.° 626.123.211.111- Site.: www.cetesb.sp.gov.br

Cód.: S010V03 *14/10/2003*

Appendix 4: Landfill Operation License

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

02

Processo Nº 16/00033/96

Nº 16002151

Data 06/10/2003

LICENÇA DE OPERAÇÃO PARCIAL
VALIDADE ATÉ : 06/10/2008

Ampliação LO PARCIAL

IDENTIFICAÇÃO DA ENTIDADE

Nome	CNPJ
LARA COMÉRCIO E PRESTAÇÃO DE SERVIÇOS LTDA.	57.543.001/0001-08
Logradouro	Cadastro na CETESB
AVENIDA GUARACIABA	442 - 00253 - 8

Número	Complemento	Bairro	CEP	Município
430		SERTAOZINHO	09370-800	MAUÁ

CARACTERÍSTICAS DO PROJETO

Atividade Principal

Descrição	Código
ATERRO SANITÁRIO-CODISPOSIÇÃO DE RESÍDUOS INDUSTRIAIS CLASSES II E III	31.40.00-1

Bacia Hidrográfica	UGRHI
2 - TIETÊ ALTO ZONA METROPOLITANA	6 - ALTO TIETÊ

Corpo Receptor — Classe: 0

Área (metro quadrado)

Terreno	Construída	Atividade ao Ar Livre	Novos Equipamentos	Lavra(ha)
404244,30		70616,40		

Horário de Funcionamento (h)

Início		Término
00:01	às	23:59

Número de Funcionários

Administração	Produção
0	0

Licença de Instalação

Data	Número
01/03/2002	16001745

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.

USO DA CETESB

SD Nº 16005375

ENTIDADE

EMITENTE

Local: Agência Ambiental de Santo André

Pag. 1

Eng. Luiz Antonio Brun
Gerente da Agência Ambiental
de Santo André
Reg. 16.2623-0 CREA 112.699/D

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

02

Processo Nº 16/00033/96

LICENÇA DE OPERAÇÃO PARCIAL

Nº 16002151

Data 06/10/2003

OBSERVAÇÕES:

1. - A presente Licença de Operação Parcial está sendo concedida para uma área ampliada de 70.616,40 m² para a codisposição de resíduos domésticos e industriais classes II e III, assim classificados conforme a NBR 10004 da ABNT.

   - Por ocasião do inicio de operação do aterro em questão implementar o seguinte Plano de Monitoramento, adotando a metodologia de amostragem indicada abaixo, tanto para águas superficiais quanto subterrâneas;

   Parâmetros Indicadores de Contaminação das Águas Subterrâneas
   A análise das águas com a listagem completa deve ser efetuada na primeira amostragem e repetida anualmente.
   A análise das águas com listagem mínima será realizada trimestralmente a partir da segunda amostragem, e se repetirá, por três vezes, até ser completado o ciclo de um ano, ocasião em que serão analisados os parâmetros da listagem completa.
   Os resultados obtidos serão submetidos à apreciação da CETESB que, a seu critério, poderá alterar a periodicidade e os parâmetros das análises.

   LISTAGEM COMPLETA
   Características Físicas e Organolépticas:
   Condutividade elétrica; Sólidos totais dissolvidos; Dureza total; pH; Óleos e graxas; Cor aparente; Turbidez.

   Componentes inorgânicos:
   Alumínio; Bário; Cádmio; Cobre; Chumbo; Cloretos; Cromo total; Ferro total; Fosfato total; Magnésio; Manganês total; Mercúrio; Nitrogênio nitrito; Nitrogênio nitrato; Nitrogênio kjeldahl; Potássio; Selênio; Sódio; Zinco.

   Componentes orgânicos;
   BTX; Fenol; Tricloroetileno; Cloreto de metileno; Cloreto de vinila.

   Bacteriológicos:
   Coliformes totais; Coliformes fecais; Pseudomonas aeruginosos; Salmonella.

   LISTAGEM MÍNIMA
   Condutividade elétrica; Sólidos totais dissolvidos; pH; Óleos e graxas; Cloreto; Alumínio; Cromo total; Chumbo; Mercúrio; Cádmio; Ferro; Manganês; BTX; Diclorometano; Tricloroetileno; Cloreto de vinila; Coliformes totais; Coliformes fecais; DBO; DQO.

   - Em se tratando de codisposição, quaisquer resíduos oriundos de indústrias, classe II e/ou III, a serem recebidos na área deverão ser submetidos à prévia apreciação e anuência da CETESB.
2. OBS.: POR SOLICITAÇÃO DA EMPRESA FICA ALTERADO, EM 11/05/2004, O LOGRADOURO DA EMPRESA DE "AV. GUARACIABA, 1985" PARA "AV. GUARACIABA, 430". PERMANECENDO INALTERADOS OS DEMAIS ITENS.

Eng. Luiz Antonio Bom
Gerente da Agência Ambiental
de Santo André
Reg. 16.2623-0 CREA 112.6[illegible]

ENTIDADE

Pag. 2