



# **Project 0052: SALVADOR DA BAHIA LANDFILL GAS MANAGEMENT PROJECT**

BATTRE – Bahia Transferência E Tratamento de Resíduos S.A.  
(Former VEGA BAHIA – Tratamento e Transferência de Resíduos SA)

ATERRO METROPOLITANO CENTRO - SALVADOR – BA - BRAZIL

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## ***GLOSSARY OF TERMS***

AM	Approved Methodology
AMC	Aterro Metropolitano Centro (Center Metropolitan Landfill)
BATTRE	Bahia Transferência e Tratamento de Resíduos SA (former Vega Bahia)
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon dioxide
DNV	Det Norske Veritas
EDF	Methane Efficiency Destruction Factor
ER	Emission Reduction
GWP	Global Warming Potential
LFG	Landfill Gas
LPG	Liquefied petroleum gas
MVP	Monitoring and Verification Protocol
Nm <sup>3</sup>	Cubic meters in Standard Temperature and Pressure
O <sub>2</sub>	Oxygen
PAF	Administrative Procedure
PDD	Project Design Document
SD	Sustainable Development
tCO <sub>2</sub> e	Tonnes of Carbon Dioxide Equivalent
UFBA	Federal University of Bahia
UK	United Kingdom

## ***INTRODUCTION***

BATTRE implanted the biogas project in the Aterro Metropolitano Centro de Salvador (AMC) according to Project Design Document version 5 of March 2005 and the Monitoring and Verification Plan v3 of October 2003, based in the AM 0002 methodology. The project was properly validated in February 2003 (as by the validation report DNV NB 2003-1598 ver.3 of January 2004), approved by the Brazilian Government on 2<sup>nd</sup> June, 2004, registered at Executive Board at August 15<sup>th</sup>, 2005 and issued the first CER from landfill gas projects in the world at December 30<sup>th</sup>, 2005.

The biogas system has been inserted in the BATTRE ISO 9001 and 14001 systems in 2004. The quality assurance and environmental certification scopes from the Biogas management activity were audited and approved by ABS at December 23<sup>th</sup>, 2005 and the up-grade to ISO 9001/2008 and ISO 14001/2004 certification was achieved on December 22<sup>th</sup>, 2009.

## ***OBJECTIVE***

The purpose of this report is to present the amount of achieved Greenhouse Gas Emission Reductions (ER) (in tonnes of carbon dioxide equivalent) from the period from 1 January 2008 to 31 December 2009. Achieved emission reductions are to be certified by the Designated Operational Entity as per the Kyoto Protocol and CDM Modalities Procedures requirements (Decision 17.CP7).

## ***GENERAL DESCRIPTION OF THE PROJECT***

The project activity in question is located inside the Aterro Metropolitano Centro, and consists of the capture of methane produced by waste decomposition and its complete destruction by combustion at high temperature.

### **Project Participants:**

Project operator:	BATTRE Bahia Transferência e Tratamento de Resíduos S.A., (project developer)
Annex 1 Party:	Showa Shell Sekiyu K.K. (Japan) Shell Trading International Limited (UK) Electrabel S.A.

### **Project location / general data:**

The Salvador da Bahia landfill, known as “Aterro Metropolitano Centro (AMC)”, is located in a rural area, 20 km northeast downtown Salvador, Brazil. The Municipality site concession is inside Salvador metropolitan area, which includes 10 municipalities. The surroundings are residential. Although the project total area is 2,450,000 m<sup>2</sup>, the area reserved for waste disposal will be of 600,000 m<sup>2</sup>. The landfill

has a total capacity of 18,000,000 m<sup>3</sup> and receives about 820,000 tons of household waste per year. The real organic matter is approximately 60 %.

This monitoring report presents GHG emission reduction achieved during the period from 1 January 2008 to 31 December 2009, which are calculated as **1,017,423 tCO<sub>2</sub>e** (544,764 + 472,659, respectively). The claimed CER volume is 44% lower than the estimated in the PDD for these 2 years.

The volume of waste landfilled until 31 December 2008 was 8.53 millions tonnes against 8.82 millions tonnes predicted in the PDD (or 3 % less). In December/2009 the volume was 9.45 millions tonnes against 9.77 millions tonnes predicted in the PDD (or 3 % less). The detailed data can be accessed in the Salvador da Bahia Data Sheet (Solid Waste Disposal).

As established by AM0002 methodology, the amount of methane that would be destroyed in the baseline scenario for the period from 1 January 2008 to 31 December 2009 was monitored with the expected value is to be indicated in a clarification letter yet to be issued by the Municipality of Salvador confirming the value of 5% of the volume of methane collected in 2008 and 2009 to the Salvador Landfill Gas Project as the amount of methane that would be destroyed in the baseline scenario for this period.

## MONITORING INFORMATION

During the process operation, all data was monitored and recorded according to the Monitoring Plan described in the PDD. Collected data for monitoring emission reductions from the project activity and the way it was stored are as follows:

Data to be collected in order to monitor emissions from the project activity, and how this data will be archived									
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic / paper)	For how long is archived data kept?	Comment
2.1	Annual waste landfilled	Measured on site	metric tonnes	m	Daily	100%	Daily: e; monthly: p	Project lifetime	Measured at weigh bridge
2.2	Amount of methane flared	Measured on site	[t CH <sub>4</sub> ]	m	Continuous	100%	Daily: e; monthly: p	Project lifetime	Measured by continuous gas quality analyser and flow meter, or complementary method (% CH <sub>4</sub> ), Sm <sup>3</sup> /h of LFG, LFG temperature and pressure, flare temperature, flare working hours)
2.3	Total amount of methane flared	N/a	[t CH <sub>4</sub> ]	c	Daily	n/a	Daily: e; monthly: p	Project lifetime	
2.4	Amount of methane flaring required in baseline	N/a	[t CH <sub>4</sub> ]	c	Annually	n/a	Annually: e and p	Project lifetime	Contractual amount according to Municipality letter.
2.5	Amount of methane collected in addition to requirement	N/a	[t CH <sub>4</sub> ]	c	Annually	n/a	Annually: e and p	Project lifetime	
2.6	Annual Carbon Dioxide Equivalent Avoided	N/a	[t CO <sub>2</sub> e]	c	Annually	n/a	Annually: e and p	Project lifetime	

The calibration of all monitoring instruments occurred as specified on Monitoring Plan described in the PDD. When any problem occurred resulting in a lack of assurance in the quality of the data, the most conservative value was used.

### Flow meter calibration

The flow meter was calibrated as described below:

<i>Calibration date</i>	<i>TAG of the meter</i>	<i>Calibration number</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Calibration frequency</i>	<i>Precision</i>
15/06/2007	(FT-002)	1591/2007	SMAR	LD 301	yearly	0.075%
02/06/2008	(FT-002)*	215/2008	SMAR	LD 301	yearly	0.075%
25/07/2008	(FT-001)	2424/2008	SMAR	LD 301	yearly	0.075%
05/05/2009	(FT-001)*	564/2009	SMAR	LD 301	yearly	0.075%
29/09/2009	(FT-002)	687/2009	SMAR	LD 301	yearly	0.075%

\* Stand-by Flow meter.

### **Electricity meter calibration:**

The electricity meter was calibrated as described below:

<i>Calibration date</i>	<i>TAG of the meter</i>	<i>Manufacturer</i>	<i>Model</i>	<i>Calibration number</i>	<i>Calibration frequency</i>	<i>Precision</i>
04/10/2007	ME01	KRON	MKM-D	2975/2007	yearly	0.2%
30/07/2008	ME02	KRON	MKM-D	2472/2008	yearly	0.2%
05/10/2009	ME02	KRON	MKM-D	3322/2009	yearly	0.2%
20/08/2009	ME03	KRON	MKM-D	2762/2009	yearly	0.2%

### **Scale calibration:**

The two road scales used to weight the waste landfilled start its calibration at December, 10, 2004. This calibration is valid for 12 months.

TAG: BAL01: è Certificate number: 1241715 on June, 18, 2008

TAG: BAL03: è Certificate number: 1244758 on June, 29, 2009

TAG: BAL02: è Certificate number: 1241716 on June, 18, 2008

TAG: BAL04: è Certificate number: 1244757 on June, 29, 2009

## ***CALCULATION OF THE EMISSION REDUCTIONS***

### **Baseline calculation:**

As established by AM0002 methodology and in the PDD, the amount of methane that would be destroyed in the baseline scenario for the period from 1 January 2008 to 31

December 2009 is established as the contractual obligation of BATTRE with the Concessionary of the Salvador Landfill, which is the Municipality.

**Project emissions:**

The potential sources of project emissions are (i) emissions due to the consumption of grid electricity and (ii) emissions due to the consumption of LPG (used for flare starting by the flare pilot). Such emissions are attributable to the project activity. It is important to note that according to both the PDD and AM0002 methodology, these emissions are described as leakage. The following table describes how data will be collected and archived on these emission sources.

ID	Data type	Data variable	Data unit	Measured (m), calculated (c) estimated (e)	Recording Frequency	How will the data be archived? electronic: e paper: p	For how long is archived data kept?
3.1	Electricity	Total amount of electricity consumed by the project activity.	[kWh]	m	Monthly	e or p	All data will be kept up to 3 years after the end of crediting periods.
3.2	Emission factor	GHG emissions per kWh of electricity used (Combined Margin Emission Factor for the electricity grid)	kg of CO <sub>2</sub> /kWh	c or e	Annually	e or p	All data will be kept up to 3 years after the end of crediting periods.
3.3	Emission factor	GHG emissions per kg of LPG used. (Emission factor for consumed LPG)	kg of CO <sub>2</sub> /TJ	c or e	Annually	e or p	All data will be kept up to 3 years after the end of crediting periods.



### Approach for determining the emission factor for consumption of LPG

The emission factor from the LPG ( $EF_{LPG}$ ) is 63,100 kg of CO<sub>2</sub> per TJ on a Net Calorific Basis according to IPCC 2006.

([http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2\\_Volume2/V2\\_2\\_Ch2\\_Stationary\\_Combustion.pdf](http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf)).

For the calculation of the emissions due to the consumption of LPG by the project activity, the CO<sub>2</sub> emission factor for LPG was determined considering the net calorific value (NCV) of LPG which was consumed by the project activity.

LPG net calorific value (NCV):	1.09 * 10 <sup>7</sup> Kcal/tonne 0.0456 TJ/tonne (conversion factor 4,186.8 J/Kcal)
CO <sub>2</sub> emission factor for LPG:	63,100 kg CO <sub>2</sub> /TJ 2.9 tonne CO <sub>2</sub> e/tonne LPG (based on the NCV of LPG consumed by the project activity)

### Approach for determining the emission factor for consumption of grid electricity

The Emission Factor of Brazilian Grid ( $EF_{electricity}$ ) is calculated as the average of the Build Margin (BM) and Operating Margin (OM) of the Brazilian Grid for each year

$EF_{electricity}$  calculated for the year 2008 is used to calculate emissions due to the consumption of grid electricity for both years 2008 and 2009 as official data for year 2009 is not fully available.

$EF_{electricity}$  calculation is available at:

<http://www.mct.gov.br/index.php/content/view/303077.html#ancora>

Emission Factor <sub>2008</sub> (tCO <sub>2</sub> /MWh)		
Build Margin	Operating Margin	Combined Margin
0.1458	0.4766	0.3112

### Approach for determining the emission reductions achieved by the project activity:

Emission reductions were calculated according to the Methodology AM0002, which states:

*The greenhouse gas emission reduction achieved by the project activity is the difference between the amount of methane actually destroyed and the amount of methane required to be flared under the terms of the contract. The greenhouse gas emission reduction is expressed in terms of CO<sub>2</sub> equivalents using the approved Global Warming Potential value for the relevant period.*

*Specifically, the greenhouse gas emission reduction ( $ER_y$ ) achieved by the project activity during a given year ( $y$ ) is equal to the methane emission reduction ( $ER_{CH_4y}$ ) due to the project activity during that year multiplied by a*

conversion factor (CF) and by the approved Global Warming Potential value for methane (GWP<sub>CH<sub>4</sub></sub>).

$$ER_y = ER_{CH_4y} * CF * GWP_{CH_4}$$

*ER<sub>y</sub>* is the greenhouse gas emission reduction measured in tonnes of CO<sub>2</sub> equivalents (t CO<sub>2</sub>e).

*ER<sub>CH<sub>4</sub>y</sub>* is the methane emission reduction measured in cubic meters (m<sup>3</sup>(STP) CH<sub>4</sub>) of methane.

The conversion factor (CF) is the tonnes of methane per cubic meter of methane at standard temperature and pressure (0.000662 tonnes CH<sub>4</sub>/m<sup>3</sup>(STP) CH<sub>4</sub>).

The Global Warming Potential converts 1 tonne of methane to 21 tonnes of CO<sub>2</sub> equivalents (tonnes CO<sub>2</sub>e/tonne CH<sub>4</sub>).

The approved Global Warming Potential value for methane for the first commitment period is 21 tonnes CO<sub>2</sub>e/tonnes CH<sub>4</sub>. Thus, GWP<sub>CH<sub>4</sub></sub> = 21 until December 31, 2012.

The methane emission reduction (*ER<sub>CH<sub>4</sub>y</sub>*) due to the project activity is calculated as the difference between amount of methane actually captured and flared less the amount of methane captured and flared in the baseline, which is the amount specified by the contract corrected for the quantity of waste received and the actual methane content of the landfill gas.

The contractor establish that the baseline methane volume in the contract is 20% of the total volume of methane collected

$$ER_{CH_4y} = CH_{4flared,y} - CH_{4baseline,y}$$

*CH<sub>4flared,y</sub>* is determined by monitoring the quantity of methane actually flared using the approved monitoring methodology. *CH<sub>4flared,y</sub>* is measured in cubic meters (Nm<sup>3</sup>).

## ***GHG EMISSION REDUCTIONS FOR THE YEAR 2008***

The total emission reductions achieved during year 2008 are **544,764 tCO<sub>2</sub>e**

### **Calculation MEMO for 2008:**

Baseline quantity of methane flared  $CH_4_{\text{baseline,y}} = 5\%$  from total amount of methane flared. This is in accordance with the expected value to be indicated in a clarification letter yet to be issued by the Municipality of Salvador.

**Emission Factor of Brazilian Grid ( $EC_{2008}$ ) = 0.3112 tCO<sub>2</sub>e/MWh**

Amount of electricity consumed by the project activity ( $EP_{2008}$ ): 1,373 MWh

CO<sub>2</sub> emissions due to the consumption of grid electricity ( $EE_{2008}$ ):

$$EE_{2008} = EP_{2008} * EC_{2008} = 0.3112 \text{ tCO}_2\text{e/MWh} * 1,373 \text{ MWh} = 427 \text{ tCO}_2\text{e}$$

**Emission factor for LPG ( $EF_{LPG}$ ) = 2.9 tonne CO<sub>2</sub>e/tonne LPG**

Amount of LPG consumed by the project activity ( $LPG_{2008}$ ): 0.09 tonne

CO<sub>2</sub> emissions due to the consumption of LPG ( $ELPG_{2008}$ ):

$$ELPG_{2008} = LPG_{2008} * EF_{LPG} = 0.09 \text{ tonne} * 2.9 \text{ tonne CO}_2\text{e/tonne LPG} = 0.27 \text{ tCO}_2\text{e}$$

( $ELPG_{2008}$  is considered as 1 tCO<sub>2</sub>e as a conservative measure.)

**Methane Efficiency Destruction Factor (EDF) = 0.999974**

It was used the lower value for burning efficiency, which was measured in 2008

The flare destruction efficiency was determined based on conducted measurements of amount of residual methane by an independent third party. Results of the performed measurements are as follow:

1<sup>o</sup> Measurement: (99.9997% - 99.9981%)

2<sup>o</sup> Measurement: (99.9997%-99.9980%)

3<sup>o</sup> Measurement: (99.9995%-99.9983%)

4<sup>o</sup> Measurement: (99.9993%-99.9974%)

The lowest measured/calculated value of flare destruction efficiency (99.9974%) was used for the year 2008 as a conservative measure.

Parameter	Item	Volume (Nm <sup>3</sup> of CH <sub>4</sub> )	Mass (t of CH <sub>4</sub> )
CH <sub>4</sub> flared,2008	Total amount of methane flared	41,281,929	27,329
	Amount of Methane used in Energy Generation	0	0
CH <sub>4</sub> baseline,2008	Amount of methane required to be flared in the baseline	2,064,096	1,366
ER <sub>CH4,2008</sub>	Amount of methane emission reduction due to the project activity	39,217,833	25,962

The volume of flared methane is multiplied by 0.000662 tonnes/Nm<sup>3</sup> (density of CH<sub>4</sub>), in order to convert the value for a mass basis (tonnes of CH<sub>4</sub>). Values in tonnes of CH<sub>4</sub> are multiplied by GWP\_CH4 (21) and the EDF (99.9974%) for determining the emission reduction for year 2008.

Applying leakage (emissions due to consumption of grid electricity + LPG by the project activity):

Emission reduction (ER <sub>2008</sub> )	tCO <sub>2</sub> e	545,192
EE <sub>2008</sub>	tCO <sub>2</sub> e	427
ELPG <sub>2008</sub>	tCO <sub>2</sub> e	1
<b>Annual Carbon Dioxide Equivalent Avoided in 2008</b> ( = ER <sub>2008</sub> - EE <sub>2008</sub> - ELPG <sub>2008</sub> )	<b>tCO<sub>2</sub>e</b>	<b>544,764</b>

## ***SUSTAINABLE DEVELOPMENT MEMO - YEAR 2008***

The SD indicators are monitored as established in Battre's procedure PAF 012.

Battre has assumed a commitment to voluntarily allocate 5% of the net income from the sale of issued CERs to activities that would benefit the local community, environment and economy. While, such capital expenditures were initially planned to occur only after issuance and commercialization of the CERs, BATTRE has already spent R\$ 170,120.74 (USD 97,212) with specific projects.

### **Economic Development Indicators**

The accumulated direct employment indicator (new jobs generated by the biogas project) is 20 (19 BATTRE's employees and 1 ZLF consultant that render totally dedicated coordination services). No new job was created in 2008.

The salary indicator confirmed that, despite a few new jobs, the LFG collection and destruction project has salaries which are higher in relation to the Landfill and the Residue Transfer Station, and so being an activity that requires higher qualification.

Income generation index

Landfilling operations:	7.09
Operations of the waste transfer station:	6.50
LFG collection and destruction project:	8.91

## **Environmental and Social Development Indicators**

The waste density was calculated based on the landfill topographic assessments reaching 1.12 tonne/m<sup>3</sup>.

Reforestation activities has been included in the Landfill Environmental Management Plan. To do so, a biologist selected reforestation areas giving priority to the riparian forests. The reforestation activities performed in 2008 achieved 0.15 ha (1,501 m<sup>2</sup>) according to the report issued by the selected biologist.

The "Estação das Formas" Program, which was hired to supply environmental educational services to BATTRE was extended to 2,125 children.

Complaints regarding odor (odor level classified as strong or medium) according to visitors' registries + CAC Support Center + interviews regularly conducted correspond to 23% of total odor related comments. From years 2003 to 2007 the corresponding values were 41%, 36%, 29%, 50% and 39% respectively.

With regard to safety, there were 2 notified and registered accidents with dismissal in year 2008. The accident frequency indicator is 8.46 (number of accidents per 1 million worked hours) and the gravity indicator is 0.31 (day per 1million worked hours). Both indicators are under the company targets.

The air pollution data are evaluated annually with a set of analyses, performed by CEPED (Centro de Pesquisa e Desenvolvimento). The analyzed parameters continued to register ND values (not detectable) or under the equipment low detection level.

The leachate infiltration indicator is 47.9%. From years 2003 to 2007 the corresponding values are 39.8%, 49.8%, 50.1%, 40.4% and 62.1% respectively.

## **Technology Transfer Indicators**

Transfer of technology has been performed via seminars organized/sponsored/joined by BATTRE.

Mark Zulauf (consultant) and João Fortuna (employee) have acted as members of the Global Climate Change and Biodiversity Bahia Forum since year 2005.

In order to make information related to the operation of "Salvador da Bahia LFG Project" publicly available, BATTRE and UFBA have jointly developed the website

[www.solvi.com/battre](http://www.solvi.com/battre) and [www.geoamb.eng.ufba.br](http://www.geoamb.eng.ufba.br). These websites are aimed to support and improve transfer of technology and knowledge in the field of biogas capture, destruction and utilization.

## ***GHG EMISSION REDUCTIONS FOR THE YEAR 2009***

The total emission reductions achieved during year 2009 are **472,659 tCO<sub>2</sub>e**

### **Calculation MEMO for 2009:**

Baseline quantity of methane flared  $CH_{4\text{baseline},y} = 5\%$  from total amount of methane flared. This is in accordance with the expected value to be indicated in a clarification letter yet to be issued by the Municipality of Salvador.

**Emission Factor of Brazilian Grid ( $EC_{2009}$ ) = 0.3112 tCO<sub>2</sub>e/MWh**

Amount of electricity consumed by the project activity ( $EP_{2009}$ ): 1,229 MWh

CO<sub>2</sub> emissions due to the consumption of grid electricity ( $EE_{2009}$ ):

$$EE_{2009} = EP_{2009} * EC_{2009} = 0.3112 \text{ tCO}_2\text{e/MWh} * 1,229 \text{ MWh} = 382 \text{ tCO}_2\text{e}$$

**Emission factor for LPG ( $EF_{LPG}$ ) = 2.9 tonne CO<sub>2</sub>e/tonne LPG**

Amount of LPG consumed by the project activity ( $LPG_{2009}$ ): 0.09 tonne

CO<sub>2</sub> emissions due to the consumption of LPG ( $ELPG_{2009}$ ):

$$ELPG_{2009} = LPG_{2009} * EF_{LPG} = 0.09 \text{ tonne} * 2.9 \text{ tonne CO}_2\text{e/tonne LPG} = 0.27 \text{ tCO}_2\text{e}$$

( $ELPG_{2009}$  is considered as 1 tCO<sub>2</sub>e as a conservative measure.)

**Methane Efficiency Destruction Factor (EDF) = 0.999979**

It was used the lower value for burning efficiency, which was measured in 2009

The flare destruction efficiency was determined based on conducted measurements of amount of residual methane by an independent third party. Results of the performed measurements are as follow:

1<sup>o</sup> Measurement: (100%-99.9996%)

2<sup>o</sup> Measurement: (99,9989%-99.9979%)

3<sup>o</sup> Measurement: (99,9992%-99.9984%)

4<sup>o</sup> Measurement: (99,9994%-99.9988%)

The lowest measured/calculated value of flare destruction efficiency (99.9979%) was used for the year 2009 as a conservative measure.

Parameter	Item	Volume (Nm <sup>3</sup> of CH <sub>4</sub> )	Mass (t of CH <sub>4</sub> )
CH <sub>4</sub> flared,2009	Total amount of methane flared	35,818,559	23,712
	Amount of Methane used in Energy Generation	0	0
CH <sub>4</sub> baseline,2009	Amount of methane required to be flared in the baseline	1,790,928	1,186
ER <sub>CH4,2009</sub>	Amount of methane emission reduction due to the project activity	34,027,631	22,526

The volume of flared methane is multiplied by 0.000662 tonnes/Nm<sup>3</sup> (density of CH<sub>4</sub>), in order to convert the value for a mass basis (tonnes of CH<sub>4</sub>). Values in tonnes of CH<sub>4</sub> are multiplied by GWP\_CH4 (21) and the EDF (99.9979%) for determining the emission reduction for year 2009.

Applying leakage (emissions due to consumption of grid electricity + LPG by the project activity):

Emission reduction (ER <sub>2009</sub> )	tCO <sub>2</sub> e	473,042
EE <sub>2009</sub>	tCO <sub>2</sub> e	-382
ELPG <sub>2009</sub>	tCO <sub>2</sub> e	-1
<b>Annual Carbon Dioxide Equivalent Avoided in 2009</b> ( = ER <sub>2009</sub> - EE <sub>2009</sub> - ELP <sub>2009</sub> )	<b>tCO<sub>2</sub>e</b>	<b>472,659</b>

## ***SUSTAINABLE DEVELOPMENT MEMO - YEAR 2009***

The SD indicators are monitored as established in Battre's procedure PAF 012.

Battre has assumed a commitment to voluntarily allocate 5% of the net income from the sale of issued CERs to activities that would benefit the local community, environment and economy. While, such capital expenditures were initially planned to occur only after issuance and commercialization of the CERs, BATTRE has already spent R\$ 178,798.07 (USD 102,170) with specific projects.



## **Economic Development Indicators**

The accumulated direct employment indicator (new jobs generated by the biogas project) is 22 (21 BATTRE's employees and 1 ZLF consultant that render totally dedicated coordination services). Two new jobs were created in 2009.

The salary indicator confirmed that, despite a few new jobs, the LFG collection and destruction project has salaries which are higher in relation to the Landfill and the Residue Transfer Station, and so being an activity that requires higher qualification.

Income generation index

Landfilling operations:	7.43
Operations of the waste transfer station:	6.12
LFG collection and destruction project:	8.33

## **Environmental and Social Development Indicators**

The waste density was calculated based on the landfill topographic assessments reaching 1.14 tonne/m<sup>3</sup>.

Reforestation activities has been included in the Landfill Environmental Management Plan. To do so, a biologist selected reforestation areas giving priority to the riparian forests. The reforestation activities performed in 2009 achieved 0.28 ha according to the report issued by the selected biologist.

The "Estação das Formas" Program, which was hired to supply environmental educational services to BATTRE was extended to 3,348 children.

Complaints regarding odor (odor level classified as strong or medium) according to visitors' registries + CAC Support Center + interviews regularly conducted correspond to 25% of total odor related comments. From years 2003 to 2008 the corresponding values were 41%, 36%, 29%, 50%, 39% and 23% respectively.

With regard to safety, there were 5 notified and registered accidents with dismissal in year 2009. The accident frequency indicator is 20.7 (number of accidents per 1 million worked hours) and the gravity indicator is 1.17 (day per 1million worked hours).

The air pollution data are evaluated annually with a set of analyses, performed by CEPED (Centro de Pesquisa e Desenvolvimento). The analyzed parameters continued to register ND values (not detectable) or under the equipment low detection level.

The leachate infiltration indicator is 48.2%. From years 2003 to 2008 the corresponding values are 39.8%, 49.8%, 50.1%, 40.4%, 62.1% and 47,9% respectively.

## **Technology Transfer Indicators**

Transfer of technology has been performed via seminars organized/sponsored/joined by BATTRE.

Mark Zulauf (consultant) and João Fortuna (employee) have acted as members of the Global Climate Change and Biodiversity Bahia Forum since year 2005.

In order to make information related to the operation of “Salvador da Bahia LFG Project” publicly available, BATTRE and UFBA have jointly developed the website [www.solvi.com/battre](http://www.solvi.com/battre) and [www.geoamb.eng.ufba.br](http://www.geoamb.eng.ufba.br). These websites are aimed to support and improve transfer of technology and knowledge in the field of biogas capture, destruction and utilization.

### **Professionals in charge:**

Reinaldo Bomfim – Director

Mark Rudolf Zulauf – Consultant

## ***MVP DATA WORKSHEETS***

SUMMARY ER CALCULATION

FACTOR

SOLID WASTE DISPOSAL

METHANE FLARING

LEAKAGE CALCULATION

METHANE TO ENERGY

ELECTRICAL GENERATION

SD INDICATORS