Project design document form for CDM project activities

(Version 05.0)

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Salvador da Bahia Landfill Gas Management Project
Version number of the PDD	Version 7
Completion date of the PDD	28/01/2015
Project participant(s)	BATTRE Bahia Transferencia e Tratamento de Resíduos S.A. Showa Shell Sekiyu K.K. Shell Trading International Limited Electrabel S.A.
Host Party	Brazil
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	CDM Sectoral Scope 13 – Waste handling and disposal. AM0002 - Greenhouse Gas Emission through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract (Version 1)
Estimated amount of annual average GHG emission reductions	406,115 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The project activity named "Salvador da Bahia Landfill Gas Management" encompasses the construction and operation of a landfill gas (LFG) collection and destruction infrastructure at the Aterro Metropolitano do Centro landfill (AMC landfill). The AMC landfill is located in the Municipality of Lauro de Freitas, Bahia State, in the Northeast region of Brazil.

This landfill is the disposal site for all municipal solid waste (MSW) generated and collected at the city of Salvador (capital of Bahia State). The AMC landfill was built in 1999 and has employed *state-of-the-art* waste landfilling technics and management. In the absence of the CDM project activity, which was implemented and started operations in the end of year 2003, no appropriated management of LFG emissions at the AMC landfill would occur[1].

The project activity involves the installation of all equipment and instruments which are required to promote LFG collection and destruction (in high temperature enclosed flares) at the AMC landfill[2].

[1] This PDD is valid for the 1st 7-year renewable crediting period for the project activity (period from 01/01/2004 to 31/12/2010). It is important to note that the 1st 7-year crediting period is already expired. This revised version of the PDD addresses minor inconsistencies recently identified on the previous version of the PDD (version 6, dated 27/12/2013) (that represents a version of the PDD with major revisions). At the time of the compilation of both this revised version of the PDD (version 7) as well as its previous version (version 6) about 4 and 3 years after the end of the 1st crediting period respectively, there were still pendent CER issuance requests for all the 6-year period from 01/01/2005 to 31/12/2010. While the previous version of the PDD (version) was compiled in order to meet requirements for the related pendent CER issuance in terms of post-registration changes as per the currently valid CDM regulatory framework *VVS track*, this revised version of the PDD (version 7) merely addresses identified minor inconsistencies, as outlined in Appendix 6, that were not addressed in version 6 of the PDD and tha are thus also required to be addressed as post-registration changes. As per the current CDM rules, applicable post-registration changes are to be addressed under revision of the PDD.
In accordance with the currently valid and applicable CDM procedure for submissions of updated project documentation, the latest version of the CDM-PDD form (CDM-PDD form version 05.0) is the form applied in the context of the revision of the PDD. It is important to note that, at the time the version of the registered PDD precedents to both this revised version (version 7) and version 6 was compiled (version 5, dated March 2005) and was assessed/approved by both the DOE in charge of its CDM validation and by the CDM-EB, the existent rules and requirements for completing the CDM-PDD form (including the descriptions of the project design, applied technology, definition of project boundary, identification of the baseline scenario, demonstration of additionality for the project activity, etc.) were not as detailed and well-structured as the currently valid applicable CDM rules and requirements. Both the previously registered version of the PDD (version 5 dated March 2005) and the CDM baseline and monitoring methodology AM0002 somehow reflect the "learning-by-doing" phase of the CDM during the years 2003 to 2005 (date when these documents were issued). In this sense, besides of addressing all the post-registration changes (which are summarized in Appendix 6), both revised versions of the PDD (version 6 (dated 27/12/2013 and this version of the PDD) also include a complete review of project related information (incl. project design description, description of methodological approaches, etc.). The performed complete review of project related descriptions aims to improve the overall comprehension of the project design, applied methodological approaches/choices both in terms of GHG calculations (e.g. determination of emission reductions achieved by the project activity) as well as in terms of applicable monitoring requirements and even relevant environmental aspects for the project activity.

[2] Although not considered in the project design description made available in both this revised version of the PDD as well has its previous version (version 6, dated 27/12/2013), (which are both valid for the already expired 1st 7-year crediting period), since 1 January 2011 (which is the date when the yet to be renewed 2nd 7-year crediting period starts) the project activity has started to operate with most of collected LFG being utilized as gaseous fuel for electricity generation in a new 20.1 MW electricity generation facility which was built as a permanent change in the design of the project activity and entered into operation on that date. Such utilization of LFG in a large-scale electricity generation facility, which was not previously considered in the project design, represents a permanent post-registration change in the project design which is valid for the 2nd 7-year crediting period and will thus be opportunity addressed in the yet to be valided PDD valid for the 2nd crediting period.
For sake of completeness and transparency, information/clarification and further details about the implementation of this new electricity generation facility as a permanent change in the design of the registered CDM project activity in the context of a yet to be renewed 7-year crediting period are presented in Appendix 3 of this PDD. This Appendix also includes detailed explanations and justification regarding the claimed independence between the

At the time of the project's initial design conceptualization[3], the LFG flaring capacity for the project activity was designed to be 6,250 m^3/h with gradual expansion along the landfill lifetime up to 46,250 m^3/h (LFG flaring capacity forecasted to be available by year 2020).

Installed equipment consist of vertical LFG collecting wells which are interconnected through a LFG pipeline network (made of High Density Polyethylene (HDPE) pipes, manifolds and connecting parts). Through the LFG pipeline network, all collected LFG is directed to a LFG destruction facility for combustion in enclosed high temperature flare(s)[4].

The scenario existing prior to the implementation of the project activity represents LFG (with high content of methane) being freely emitted into the atmosphere without any treatment, collection, combustion or control (baseline scenario) and with a small share of generated LFG being combusted in existing passive (conventional) LFG venting/combustion drains as required by contractual agreements set by the operator of the AMC landfill and the Administration of the Municipality of Salvador (municipal authority).

Thus, the baseline scenario is the same as the scenario prior to the implementation of the project activity[5].

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project design valid for the 1st crediting period (as described in this revised version of the PDD) and the implementation of this new electricity generation facility (as a permanent change of the design of the registered CDM project activity of which eligibility is to be assessed by an eligible DOE and approved by the CDM Executive Board (CDM-EB) in the context of the 2nd 7-year renewable crediting period. It is also important to note that the request of renewal is yet to be validated by a DOE and approved by the CDM-EB.

[3] The period encompassing years 2002 and 2003 is when the initial conceptualization of the general design of the project activity was undertaken. All information, assumptions and details applicable in the context of the initial project design (as earlier indicated in the first registered version of the PDD) are referred in this revised version of the PDD as "*information available at the time of the project design initial conceptualization*" and refers to information and assumptions which were dated/valid at the period encompassing years 2002 and 2003.

[4] At the time of the project design initial conceptualization, the use of captured LFG as gaseous fuel for electricity generation was indeed considered and evaluated by the project participants. Anyhow, this utilization alternative for collected LFG ended up not being encompassed by the project design. Appendix 3 includes details about the previous consideration of use of LFG as gaseous fuel for electricity generation as part of the project design, which was never implemented during the already expired 1st 7-year crediting period.

[5] In the absence of the project activity, all LFG generated at the AMC landfill (with high content of methane) would be freely emitted into the atmosphere without any treatment, collection, combustion or control. Such emission of LFG would occur through the surfaces of the landfill and through passive and conventional LFG venting/combustion drains. It is assumed that a small fraction of generated LFG would be destroyed in passive and conventional LFG venting/combustion drains in order to address safety and/or odor concerns. The use of conventional LFG venting/combustion drains (which are assumed to be the only LFG management infrastructure to be used in the absence of the project activity (baseline scenario)) are of somehow rudimentary design and, in most of the cases, they do not allow continuous combustion of LFG as these rudimentary LFG management solutions are not conceived/designed for ensuring continuous or efficient combustion of LFG. The following reasons/aspects justify non-continuous combustion of LFG at conventional LFG venting/combustion drains:

- Design aspects and operational conditions of the conventional LFG venting/combustion drains that would otherwise be used (such as the diameter of the LFG venting drains, average pressure of LFG in the drains, influence of wind and other climate aspects (e.g. rains)),
- Landfill operational conditions and practices at the AMC landfill in the absence of the project where no working staff would be required to attempt ensuring continuous combustion of LFG in the drains and/or monitor the conditions/status of such drains (e.g. regular checking whether the drains are alight)). This is the normal practice at landfills in Brazil with forced active LFG collection and destruction/utilization system;
- Since the time the project activity was designed, there are still no applicable legal/regulatory requirements to collected and destroy methane in the AMC landfill or at any other landfill in Brazil.
- In the absence of the project activity (baseline scenario), the operator of AMC landfill would not have any real incentive or obligation to convert the existing LFG venting/combustion drains into a more appropriate LFG flaring system/solution as such conversion would represent additional costs.

Thus, in the absence of the proposed CDM project activity, it is assumed that continuous combustion of LFG in the conventional and passive LFG venting/combustion drains that would be otherwise installed would not be a practice under the baseline scenario. The practice in the baseline scenario is assumed as being both venting and partial

While methane is a powerful greenhouse gas (GHG), the baseline situation encompassing fugitive emissions of LFG into the atmosphere[6] contributes to global warming. Furthermore, free and uncontrolled emissions of methane through the landfill surface (and through the conventional passive LFG venting /combustion drains) also create potential risks of fire, explosion as well as bad odors. The collection and destruction of LFG through an active (forced) LFG collection and flaring system greatly reduces such risks and also contributes to reduce GHG emissions.

Contribution towards Sustainable Development in Brazil:

The project activity contributes towards Sustainable Development in Brazil. Besides of promoting GHG emission reduction, the project activity also promotes other benefits.

At the time of the project's initial design conceptualization, the project was regarded as consistent with criteria that were mentioned in a discussion paper dated April 2002 on the performance metrics for sustainable development for CDM projects in Brazil which was published by the Brazilian Ministry of Environment ("*Criterios de Elegibilidade e Indicadores de Sustentabilidade para Avaliacao de Projetos que Contribuam para a Mitigacao das Mundancas Climaticas e para a Promoção do Desenvolvimento Sustentável*."[7]).

At the time of the project design initial conceptualization, the implementation of the project activity was regarded as a real demonstration of the application of a world-class methane capture system in Brazil. Furthermore, at that time, BATTRE (formerly "Vega Bahia Tratamento de Resíduos S.A.") also proposed to voluntarily allocate 5% of value from net proceeds from sale of GHG emission reduction units (Certified Emission Reductions – CERs) to sponsor activities that would benefit the local community, environment, and economy. At that time, like its parent company SUEZ[8], BATTRE (formerly "Vega Bahia Tratamento de Resíduos S.A.") already had a strong past record of demonstrating corporate social responsibility through social and environmentally friendly initiatives and visualized the implementation of the project activity as one more opportunity to illustrate the benefits of such activities. In the past, BATTRE has previously contributed to the local community by financing a capacity-building course for young scavengers from Salvador City and part of the construction of a sorting centre (operated by 80 ex-scavengers now organised as an independent co-operative). It would seek to build on these initiatives.

Besides climate change mitigation, the project activity also promotes important local environmental benefits. LFG contains trace amounts of volatile organic compounds, which are local air pollutants. Capturing of LFG using an active (forced) collection system and its controlled combustion (by flaring) greatly reduces such emissions, thereby contributing towards sustainable development. Furthermore, the implementation and operation of the project activity promotes strong reduction of LFG odors at the landfill and nearby regions.

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combustion of LFG under uncontrolled and non-systematic manner in such conventional LFG venting/combustion drains.

[6] While the LFG collection efficiency promoted by the project activity is lower than 100%, fugitive emissions of LFG into the atmosphere are obviously also expected to occur under the project scenario (but under a significantly reduced magnitude). As per AM0002 (version 1), emission reductions are determined by assuming as baseline emissions the quantity of LFG actually collected and destroyed (by combustion) by the project activity minus the quantity of LFG which is assumed that would be destroyed by a set of conventional passive LFG venting/combustion drains that would be made available at AMC landfill in the absence of the project (baseline scenario).

[7] The paper title is translated into English language as: "*Eligibility Criteria and Sustainable Development Indicators for Assessment of Projects Contributing Towards Mitigation of Climate Change and for Sustainable Development".*

[8] At the time of the project initial design conceptualization, SUEZ Environment was owner and operator of the AMC landfill. Operations of SUEZ Enviroment. In year 2006, through a management buy-out process, assets and operations of SUEZ Environment in Brazil are sold and "Solvi Group" is created. Solvi Group is the current main shareholder of BATTRE.

As a summary, the project provides the following additional important local environmental and social benefits, thus contributing towards sustainable development in Brazil:

- Reduction in emissions of other air pollutants such as hydrogen sulphide (that is present in trace quantities in LFG).
- Reduction of risk of occurrence of fire and/or explosions at the landfill due to improved LFG management.
- Reduction of odors at the landfill and nearby regions.
- Local job opportunities

Based on the approach applied at the time of the project design initial conceptualization and by also taking into account the related corrections encompassed by the previously revised version of the PDD (version 6, dated 27/12/2013); it is estimated for the project activity the promotion of average annual emissions reductions of about 458,613 tCO_2e per year over the selected 7-year renewable crediting period from 01/01/2004 to 31/12/2010[9].

Box 1 – Pioneer design and implementation aspects of the project activity "Salvador da Bahia Landfill Gas Management Project" within the early stages of the CDM

The project activity "Salvador da Bahia Landfill Gas Management Project" was one of the first GHG emission reduction initiatives ever proposed in the framework of the CDM worldwide. The compilation of the PDD for the "Salvador da Bahia Landfill Gas Management Project" thus represents one of the first initiatives worldwide related to the development of a "Project Design Document" (PDD) under the CDM.

The CDM baseline and monitoring methodology AM0002 – "Greenhouse Gas Emission Reductions through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract" was one of the first CDM methodologies ever proposed and submitted to the UNFCCC as well as the second CDM methodology ever approved. This methodology was designed especially for the project activity "Salvador da Bahia Landfill Gas Management Project".

AM0002 was the first approved baseline and monitoring methodology comprising emission reductions from abatement of methane emissions in landfills. The project participants developed and proposed to the UNFCCC the draft methodological approach for this baseline and monitoring methodology, which addressed destruction of LFG. The proposed new baseline and monitoring methodology NM0004 was later approved on 26 September 2003 by the UNFCCC as "AM0002 – Greenhouse gas emission reductions through landfill gas capture and flaring where the baseline is established by a public concession contract" (version 01).

As such, both AM0002 and the registered PDD for the project activity "Salvador da Bahia Landfill Gas Management Project" somehow reflect the "learning-by-doing" phase of the CDM during the years 2003 to 2005. By considering such pioneer context, both AM0002 as well as the previous version of the registered PDD (version 5 dated March 2005) are acknowledged relatively less comprehensive and more ambiguous than many recent methodologies and documentation for other project activities registered under the CDM. These clearly reflect the "learning-by-doing" phase of the CDM during the years 2003 to 2005.

[9] As summarized in Appendix 6, ex-ante estimates of emission reduction to be achieved by the project activity during the crediting period were revised in the previous version of the PDD (version 6, dated 27/12/2013).

A.2. Location of project activity

A.2.1. Host Party

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Brazil

A.2.2. Region/State/Province etc.

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State of Bahia

A.2.3. City/Town/Community etc.

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Salvador

A.2.4. Physical/Geographical location

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The landfill where the project activity is implemented serves as a Municipal Solid Waste (MSW) disposal site for the city of Salvador (Capital of Bahia State) and other cities in the region and it is named as "*Aterro Metropolitano do Centro*" (AMC). This landfill is located in a rural area of the municipality of Lauro de Freitas (approximately 20 km North-East of downtown Salvador). The landfill site is located in the metropolitan area of Salvador (which currently includes 10 municipalities). Although the total project area is 2,500,000 m^2, the area reserved for waste disposal is 600,000 m^2. At the time of the project design initial conception, the AMC landfill had a designed total MSW disposal capacity of 18,000,000 m^3 and was expected to receive approximately 850,000 ton of MSW per year (with organic content of disposed MSW of approximately 65%)[10].

At the time of the project initial design conceptualization, the geographic system boundaries of AMC landfill included plot of 72 hectares occupied by BATTRE as well as a further 178 hectares to cover the landfill's expansion in subsequent phases as outlined in the concession agreement which was previously established between BATTRE and the Municipal Government of Salvador da Bahia.

The previously established concession agreement has validity for 20 years. The concession agreement does not require or establish the implementation of a forced (active) LFG collection and destruction initiative. However, the environmental license/permit for the AMC landfill indeed requires LFG to be captured (without clearly indicating a specific percentage capture rate)[11]. The environmental license/permit for the AMC landfill does not explicitly establishes any quantitative requirement for the amount of captured LFG should be combusted either. BATTRE's (formerly "Vega Bahia Tratamento de Resíduos S.A.") original proposal to the Municipality BID is a contractual document and formed the basis for which it received its license to operate.

[10] As per data available in December 2013, the designed total MSW disposal capacity of the AMC landfill remains being 18,000,000 m^3 of MSW. During the periods from year 1998 to year 2013, a average of about 850,000 ton of MSW per year has been disposed in the AMC landfill. The organic content of disposed MSW is assumed as remain being approximately 45% during the period (and not 65% as previously considered at the time of the project initial design conceptualization).

[11] More recently, the Administration of the Municipality of Salvador (municipal authority) issued an official communication (dated 20/08/2010) clarifying the minimum amount of methane that is required to be destroyed at the AMC landfill in the absence of the project activity. This communication meets the methodological and monitoring requirement of AM0002 for the determination of annual values for the monitoring parameter $CH4_{baseline,y}$ within the period from 2005 to 2010. Appendix 3 includes the translated version of such official communication.

Figure 1 - Project's location within Brazil

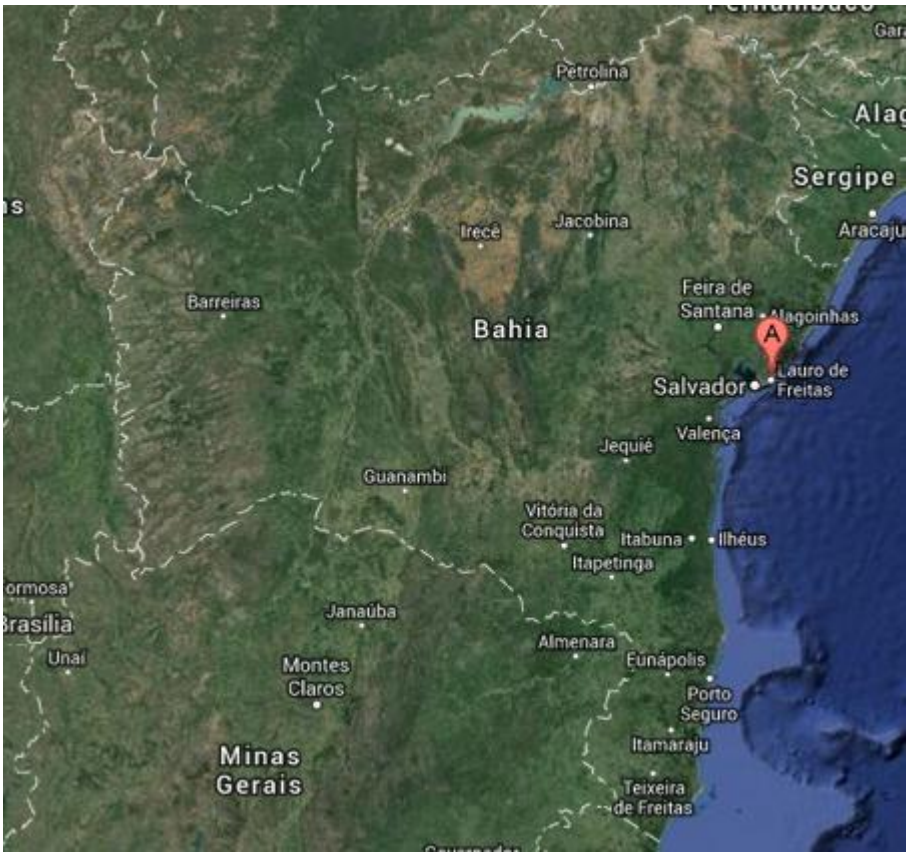

Figure 2 - Project's location within Bahia State

Figure 3 - Project's location within Lauro de Freitas municipality

The project has the following geographical coordinates:

Geographical location: 12°51'45"S (-12.8625) and 38°21'59"W (-38.3636)

A.3. Technologies and/or measures

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The "Salvador da Bahia Landfill Gas Management Project" represents a project activity proposed under CDM's Sectoral Scope 13 – Waste handling and disposal.

The scenario in the absence of the project at the AMC landfill (baseline scenario) is as follows: the non-existence of appropriate equipment, procedure and/or practices which would allow efficient LFG collection and its destruction by combustion at the landfill site. In the absence of the project activity (baseline scenario), it is assumed that a set of conventional LFG venting/combustion drains would be made available in the AMC landfill to allow passive venting and/or combustion of LFG thus avoiding significant LFG gas accumulation inside the landfill (reducing risks of fire and explosions, addressing odor concerns and sufficiently meeting the existent quantitative requirement for destruction of methane at the AMC landfill as set by the Administration of the Municipality of Salvador (municipal authority).

At the time of the project design initial conceptualization, the use of passive conventional LFG venting/combustion drains (without continuous combustion of LFG being ensured) represented the best practice for well-designed and operated landfills in Brazil (landfills without active (forced) LFG collection and destruction systems)[12].

[12] At the time of the project design initial conceptualization, there were no other initiative in Brazil encompassing active (forced) LFG collection and destruction/utilization. At that time the project represented the first initiative in the country promoting efficient collection and destruction of LFG. In December 2013, about 10 years after the design and implementation of the project activity, all existing or planned initiatives promoting efficient collection and destruction of LFG (including the project activity) were implemented (or are to be implemented) as CDM project activities. In December 2013, there were 48 registered CDM project activities promoting LFG collection and

The main GHG emissions source in the baseline scenario (absence of the project activity) is methane. It is assumed that in the baseline scenario, the landfill site would continue to have no proper equipment, procedure, and practice for promoting efficient LFG collection and destruction. It is assumed that the baseline solution would promote destruction of methane under a quantitative level sufficient to meet the contractual requirements for destroying methane at the AMC landfill as set/defined by the Administration of the municipality of Salvador (municipal authority)[13]. At the time of the project's initial design conceptualization there was no legal regional or national requirement in Brazil which would oblige LFG to be effectively collected and destroyed in landfills in Brazil. Moreover, there were no previous legal municipal, state or national law in Salvador, Bahia State and Brazil respectively that would establish any management of LFG in new or existing landfills or waste dumpsites. However, in the particular case of the AMC landfill, regardless of the lack of applicable law/regulation, the Administration of the Municipality of Salvador (municipal authority) defined that methane was to be destroyed at the landfill and this was to be considered in the

destruction/utilization in Brazil (+ initiative under CDM validation status). Source: UNEP/RisØ. The Salvador da Bahia Landfill Gas Management was actually the first designed initiative encompassing the use of an active (forced) LFG collection and its destruction in the whole South America (and probably one of the first of such initiatives being proposed in a developing country worldwide). In December 2013, there were several similar initiatives implemented or under implementation in different landfills in different regions of Brazil (with some of them encompassing utilization of collected LFG as fuel for electricity generation or export of collected and purified LFG to natural gas distribution network or utilization of LFG as fuel for industrial boilers). It is important to note that all of such initiatives hosted in Brazil were proposed as CDM project activities. Promotion of efficient and environmentally safe collection and destruction/utilization of LFG in landfills in Brazil is proven to be one of the main outcomes/benefits promoted by the CDM in Brazil.

In well-managed landfills where there is no active (forced) LFG collection and destruction/utilization system implemented, the common practice is still being the use of passive (conventional) LFG venting/combustion drains for mainly addressing safety concerns and/or eventually, if existent, to address odor concerns (with combustion of a small share of generated LFG, if occurring, being normally performed under a non-continuous basis – susceptible to interruptions due to circumstances and aspects like influence of weather, poor LFG pressure in the flare/drain, etc).

The adoption and design of improved LFG management solutions (applying passive conventional LFG venting/combustion drains depends) on different aspects such as the design of the landfill, the design and dimensions of the MSW disposal cells, average pressure of LFG in the site, overall management of the landfill, climate conditions (e.g winds, rain pattern, etc.), design and operation requirements for the landfill, etc.

In the particular case of the AMC landfill, in the absence of the project activity, conventional passive LFG venting/combustion drains would be used to combust only a small share of generated LFG in order to sufficiently meet the existent contractual requirement for the destruction of methane at this landfill as set by the Administration of the Municipality of Salvador (municipal authority).

[13] At the time of the initial project design conceptualization, it was roughly considered that the LFG management solution that would be applied in the absence of the project activity (baseline scenario) (applying LFG conventional passive LFG venting/combustion drains) would have a LFG collection and destruction efficiency of in the range from 19% to 24% of the total quantity of LFG actually generated at the AMC landfill. This very rough assumption is currently assumed to represent a complete overestimation. This is confirmed based on currently available technical literature about efficiency of passive LFG collection and venting/destruction systems: The paper "*Reducing the uncertainty of methane recovered (R) in greenhouse gas inventories from waste sector and of adjustment factor (AF) in landfill gas projects under the Clean Development Mechanism"*, (available online at the website of CETESB (the Environmental Authority for São Paulo State, Brazil: http://www.cetesb.sp.gov.br/userfiles/file/mudancasclimaticas/biogas/file/docs/artigos_dissertacoes/magalhaes_alves_santofilho_costa_kelson.pdf) calculates/estimates that in absence of the project activity, in a well-designed landfill such as the AMC landfill, the LFG destruction efficiency to be reached by an also well-designed passive and conventional LFG collection and destruction system (using conventional passive LFG venting/combustion drains) would be lower than 5% of total amount of LFG generated in the landfill. It is important to note that as per the requirements for AM0002 (version 1) (which is a CDM baseline and monitoring methodology that was compiled especially in the context of the AMC landfill), the LFG collection and destruction efficiency for the baseline LFG management solution is to be contractually defined by the Administration of the Municipality of Salvador (municipal authority). This is further explained in Section B.6.1.

proposed design of the landfill as part of the bidding process for the public concession service of MSW collection and disposal[14].

The baseline scenario thus represents the use of no efficient LFG collection and destruction at the AMC landfill for managing LFG emissions, with only a very small fraction of generated LFG being combusted in existing conventional and passive LFG venting/combustion drains (and additional new LFG venting/combustion drains that would otherwise occur as part of the expected expansion of the landfill) in order to sufficiently meet quantitative requirement set by the Administration of Salvador (municipal authority).

The project activity encompasses the implementation of an advanced active (forced) LFG collection and flaring system. Equipment installed as part of the project activity and available during the 1st 7-year crediting period includes:

- Vertical LFG collecting wells and horizontal trenches[15].
- LFG collection pipeline network, with HDPE pipes;
- 3 high temperature enclosed flares[16];
- Monitoring and control systems required to measure the flow and composition of collected LFG in order to generate every hour records for the monitoring parameter "Amount of methane flared" ($CH4_{flared,y}$) The monitoring equipment are all installed along the pipeline that directs collected LFG to the project's enclosed high temperature flares. The project system is equipped with all needed monitoring system which are required to measure all associated monitoring parameters (LFG flow, methane concentration in collected LFG, LFG pressure, LFG temperature, etc.) in order to meet not only the requirements of the baseline and monitoring methodology AM0002 (version 1) and applicable methodological tools but also for meeting applicable safety and operational requirements for the project's LFG collection and destruction system.

The operation of the project activity consists of collecting LFG in a forced manner (with the use of centrifugal blowers) and directing all collected LFG to high temperature enclosed flares for efficient combustion. Such measures enables methane contained in the LFG being destroyed through combustion, thus promoting real and permanent GHG emission reductions due to abatement of methane that would be otherwise directly emitted into the atmosphere.

The applied LFG collection and destruction technological concept is environmentally safe. At the time of the project design initial conceptualization, the project's LFG collection and destruction technology represented leading-edge technology for landfill management and LFG capture within Brazil and were assumed to serve as a replicable model for other such projects.

[14] Appendix 3 includes a translated version of the official communication issued by the Administration of the Municipality of Salvador (municipal authority) confirming the annual values of methane which are assumed as required to be collected and destroyed at the AMC landfill in the absence of the project activity (baseline scenario).

[15] In December 2013, there were about 300 vertical LFG collecting wells implemented the AMC landfill as part of the project activity. As typical in any LFG collection and destruction/utilization initiative, the number of LFG collecting wells have increased along the project operational lifetime and forecasted expansion of the landfill. As part of the normal operation of the landfill and also as part of the normal operation of the project activity, some of the LFG extracting wells are often temporarily disconnected from the project's LFG collection pipeline in order to facilitate activities of MSW disposal and compacting activities (allowing transit of machinery (wheel loaders, excavators, etc.) and trucks loaded with MSW or covering material as part of the normal operations of the AMC landfill. Furthermore, as also typical in LFG collection and destruction/utilization initiatives, some of the project's LFG extracting wells are often temporarily disconnected from the LFG collection pipeline in order to allow required repair and maintenance related services in the project's LFG pipeline and LFG wells network (welding services, repositioning of the LFG pipeline, maintenance in the head of the LFG wells, etc.).

[16] The project activity was implemented with 3 installed high temperature enclosed flares. At the end of the 1st 7-year crediting period (31/12/2010), there were still 3 installed high temperature enclosed flares.

Transferring of technology:

By taking into account the pioneer nature of the project, at the time of its initial design conceptualization, it was assumed that the applied technology were to be transferred to Brazil through the following actions:

1. Partnership with universities : Federal University of Bahia (UFBA), CEPEA/ESALQ from São Paulo University (USP), FEA from São Paulo University (USP)
2. Partnership with public agency : CETESB, São Paulo
3. Development of local equipment's suppliers: flares, blowers, measurement equipment's, gas capture network equipment and eventually gas to energy plant
4. Involvement of Brazilian engineering consultants firms that would then be able to replicate the project

While most of operation and monitoring equipment installed as part of the implementation of the project is imported material, some relevant local content in terms of equipment are installed. By taking into account the pioneer aspect of the implementation of the project activity in year 2003, it indeed promoted significant expertise and competence development in LFG management & design and operation of LFG collection and destruction system in Brazil. About 10 years after the implementation of the project activity, the technology applied by the project activity is currently available in Brazil.

The expected operational lifetime for the LFG flaring system is at least 25 years. No major technology substitution occurred during the 7-year renewable crediting period (as previously expected at the time of the project design conceptualization). Adequate operation and maintenance service has been a regular practice for the project activity during the whole crediting period. Furthermore, as per the working procedures established for the project activity, related equipment always operates in accordance with recommendations and technical requirements as established by the equipment manufacturers.

BATTRE, which at the time of the project design initial conceptualization was a wholly owned subsidiary of the multinational company SUEZ Environment, has operated and managed the AMC landfill. At that time, SUEZ Environment was operating 237 landfills throughout the world (of which 206 were located in Europe) with a total of 32.8 million ton of Municipal Solid Waste being treated waste in 2001. At that time, most of the landfills operated by SUEZ Environment were equipped with active (forced) or passive LFG capture and treatment system (particularly those requiring compliance with European waste management regulations). As par data of 2000, 16 of these landfills were equipped with power generation units (use of collected LFG as gaseous fuel for electricity generation) and were collectively generating up to 212,000 MWh of electricity per year with a total constant LFG consumption of about 115,000 m^3 per hour in the average.

The following pictures show the project configuration during the period from March 2004 to 31 December 2010:

Figure 4: View of the LFG collection and destruction station equipped with 3 enclosed flares (picture dated April 2005)

Figure 5: View of the landfill area where the project's LFG collecting wells are installed (picture dated September 2006)

The installed LFG collection system consists of a series of vertical wells and horizontal tranches which are interconnected each other through a high density polyethylene (HDPE) pipeline network. The LFG extracting wells and trenches collects LFG from the inner area of the landfill up to the top of the surface. All captured LFG is transported to the LFG destruction station through the existing HDPE pipeline network. In the LFG destruction station the following equipment/instruments are were available during the 1st 7-year renewable crediting period:

- 1 Condensate trap that separate liquids in the collected LFG (leachate and condensate);

- 3 Blowers that provide negative pressure in the LFG pipeline;
- 3 high temperature enclosed flares with nameplate flaring capacity of 6,000 m^3/hour of LFG each;
- 1 set of LFG monitoring equipment/instruments:
    - 1 LFG flow meter ,
    - 1 LFG temperature sensor,
    - 1 LFG pressure sensor,
    - 1 CH_4 content gas analyzer unit,
    - 3 thermocouples for measuring in the temperature of the exhaust gases of the flares (1 thermocouple for each enclosed flare).

During the whole 1st 7-year crediting period, all electricity demand for the whole AMC landfill (including the project activity) was met by imports of grid sourced electricity. No other electricity source (e.g use of captive off-grid electricity generator) was to be used as part of the project design during the 1st 7-year crediting period[17].

As part of the operation of the project activity, liquefied petroleum gas (LPG) has been utilized to ignite the flares whenever it was required[18].

[17] Appendix 3 includes clarification and details about the occurred implementation of utilization of LFG as gaseous fuel for electricity generation (in a 20.1 MW electricity generation facility) which represents an occurred permanent post-registration change in the project design which is valid in the context of the yet to be renewed 2nd 7-year crediting period for the project activity (from 01/01/2011 to 31/12/2017). This post-registration change is to be addressed through revision of the PDD valid for the 2nd 7-year crediting period. After the operation of the project activity as LFG collection and destruction initiative (without any commercial utilization of collected LFG) during the whole 1st 7-year crediting period, a new 20.1 MW electricity generation facility was built and entered into permanent operation on 01/01/2011. The occurred implementation of this new electricity generation facility represents a post-registration permanent change in the project design, which took effect in the context of the 2nd 7-year crediting period. This permanent post-registration change in the project design is required to be addressed as per applicable procedures for requesting approval of post-registration changes in the context of the yet to be officially renewed crediting period. While this PDD is applicable for the already expired 1st 7-year renewable crediting period, during the whole period encompassed by this first crediting period from 01/01/2004 to 31/12/2010, the project activity operated as a LFG collection and destruction initiative (with no utilization of LFG ever being promoted). As per the applicable CDM rules, this PDD reflects the project design and monitoring practice applicable for such period. Due to that, the described project design and design of the monitoring plan for the project activity does not include any utilization of LFG. It is noteworthy that, as visible in Figure 2 (dated September 2006), no electricity generation facility was implemented along the whole 1st 7-year crediting period. Figures A1, A2, A3 and A4 in Appendix 3 (all pictures dated February 2011) show the implemented new electricity generation facility powered by collected LFG of which start of operation initiated on 1 January 2011.

[18] As per the design of the flares, a small quantity of LPG is expected to be consumed for a very short period during flare lighting/igniting events (flare pilots). Apart of the flare lighting/igniting events, the flares have also operated during significant time during the already expired 1st 7-year crediting period with continuous injection of LPG (during flare normal operation) in order to improve combustion stability and attenuate identified flare vibrations problems. This was a recommendation of chartered flare experts. Such combustion stability and vibration problems were finally solved by BATTRE in year 2006 by replacing the eight existent LFG injectors of each one of the flares (6 inches diameter LFG injectors were replaced by 8 inches diameter units).

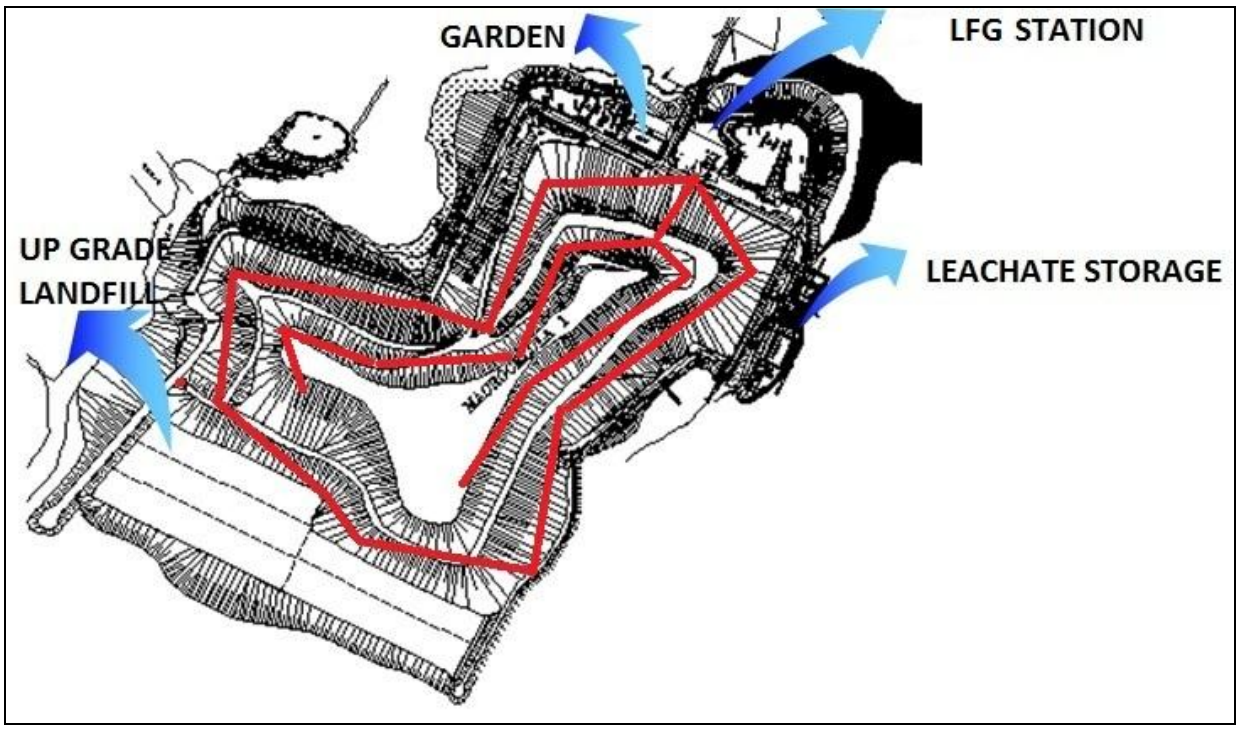

Figure 6 – Lay-Out from the Landfill, infrastructure and LFG pipeline network (in red)

A.4. Parties and project participants

Party involved (host) indicates host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	BATTRE Bahia Transferencia e Tratamento de Resíduos S.A.	No
Japan	Showa Shell Sekiyu K.K.	No
UK	Shell Trading International Limited	No
The Netherland	Electrabel S.A.	No

A.5. Public funding of project activity

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The project implementation and its operation have never involved any kind of public funding from Parties included in Annex 1. The project thus does not involve any diversion from ODA.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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For the 1st 7-year crediting period, the project activity applies the following CDM baseline and monitoring methodology:

- AM0002: "Greenhouse Gas Emission through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract" (Version 1.0) (http://cdm.unfccc.int/filestorage/A/M/0/AM0002.pdf/AM0002.pdf?t=VU58bjBneXJlfDC2CbhiukUb6fWTiD6jm0Wl)

The following methodological tools are also applied:

- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 1) (http://cdm.unfccc.int/Reference/tools/ls/meth_tool05_v01.pdf)

- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 2) (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf)

- "Tool to calculate the emission factor for an electricity system" (version 4) (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf)
-
- "Emission from solid waste disposal sites" (version 6.0.1)[19] (http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf)

Leakage emissions due to the consumption of grid-sourced electricity by the project activity are determined as per applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 1).[20] This methodological tool establishes that the CO_2 emission factor for grid-sourced electricity consumed by the project activity may be determined by applying a conservative default factor or should be determined by applying applicable guidance of the "Tool to calculate the emission factor for an electricity system".

[19] The approach applied for calculating the ex-ante estimates of emission reductions was revised. As one of the post-registration changes (under the category "Corrections (that do not affect the project design)") which was addressed by the previously revised version of the PDD (version 6, dated 27/12/2013), the ex-ante estimations of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period were revised. As explained in Appendix 6, this revision is inter alia due to the following aspect:

- Use of more appropriate approach for estimating the amount of methane to be generated at the AMC landfill and to be collected by the project activity. Such estimations are performed by applying a more recent and appropriated approach as per the methodological tool "Emission from solid waste disposal sites" (version 6.0.1).

By taking into account the relative limitations of the methodological approach of AM0002 (version 1), the ex-ante estimate of methane generation at the AMC landfill is performed by applying applicable approach of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1). Such alternative approach promotes more accurate and correct estimates of emission reductions (without affecting the amount of baseline emissions to be determined ex-post as part of the application of the project's monitoring plan + applicable GHG calculations).

[20] The use of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" is not required as per AM0002 (version 1). This pioneer baseline and monitoring methodology was published by the CDM-EB before the publication of such methodological tool. Anyhow, due to lack of appropriate guidance in AM0002 (version 1), this methodological tool is applied to determine leakage emissions due to the consumption of grid-sourced electricity by the project activity. While in more recently issued CDM baseline and monitoring methodologies, consumption of grid-sourced electricity by the project activity is regarded as "project emissions", as per AM0002 (version 1) and other pioneer CDM methodologies, consumption of grid-sourced electricity by the project activity is regarded as "leakage emissions". As summarized in Appendix 6, the previously revised version of the PDD (version 6, dated 27/12/2013) addressed as a permanent change in the monitoring plan the use of a more appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of grid-sourced electricity by the project activity (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices).

Leakage emissions due to consumption of fossil fuel LPG by the project activity are determined as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 2)[21].

B.2. Applicability of methodology and standardized baseline

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The project activity applies the baseline and monitoring methodology AM0002: "Greenhouse Gas Emission through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract" (Version 1.0). This baseline and monitoring CDM methodology was developed and proposed by the project participants for the "Salvador da Bahia Landfill Gas Management Project" and was approved by the CDM Executive Board (CDM-EB) in year 2003[22].

Since AM0002 (version 1) was approved by the CDM-EB for being applied initially for the project activity "Salvador da Bahia Landfill Gas Management Project", as a consequence, the applicability requirements/criteria for this methodology were verified to be met and respected based on the following aspects:

- For the AMC landfill, there is a landfill concession contractual agreement with includes all responsibilities for landfill design, construction, operation, maintenance and monitoring;
- The contractual agreement for MSW collection and its disposal at the AMC landfill was awarded through a competitive bidding process: Salvador municipality process #004/99[23];
- The concession contractual documents clearly indicate an amount of landfill gas to be captured and flared, referenced to the hypothetical annual quantity of waste to be received, over all contract duration[24];

[21] The use of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" is not required as per AM0002 (version 1). This pioneer baseline and monitoring methodology was published by the CDM-EB before the publication of such methodological tool. Anyhow, due to lack of appropriated guidance in AM0002 (version 1), this methodological tool is thus applied to determine leakage emissions due to the consumption of fossil fuel LPG by the project activity. While in more recently issued CDM baseline and monitoring methodologies, consumption of fossil fuel by the project activity (for use other than electricity generation) is regarded as "project emissions", as per AM0002 (version 1) and other pioneer methodologies, consumption of fossil fuel by the project activity is regarded as "leakage emissions". As summarized in Appendix 6, the previously revised version of the PDD (version 6, dated 27/12/2013) addressed as a permanent change in the monitoring plan the use of an appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of fossil fuel LPG by the project activity (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices). As also summarized in Appendix 6, the consumption of LPG by the project activity for igniting the installed high temperature enclosed flares (after temporary planned or unplaned interruptions of operation of the flares) is also ackowledged to represent an occurred permanent changes in the design of the project activity.

[22]The "Salvador da Bahia Landfill Gas Management Project" is the only ever proposed or registered CDM project activity applying the AM0002 baseline and monitoring methodology. By following applicable CDM requirements, for the 2nd 7-year crediting period (period from 01/01/2011 to 31/12/2017) the project activity will apply the latest version of "ACM0001 – Flaring or use of landfill gas". Also in accordance with applicable CDM procedures, in 2010 the project participant BATTRE has informed the CDM Secretariat about its intension to renew the crediting period for the project activity. In December 2013, the project participants had a draft PDD for the 2nd crediting period deemed completed (by applying the monitoring requirements of ACM0001 (version 15) in this PDD.

[23] Appendix 3 includes relevant clarifications about the competitive bidding process "Salvador municipality process #004/99".

[24] The amount of landfill gas required to be captured and flared at the AMC landfill (in the absence of the project activity) through the use of conventional and passive LFG venting/combustion drains for years 2005 to 2010 was confirmed by the Administration of the Municipality of Salvador (municipal authority) in an official document (dated 20/08/2010 of which a translation is enclosed in Appendix 3). This document complements the previously signed contractual agreement for MSW collection and disposal. By referring to a 3rd part independent evaluation technical paper published by the environmental authority of São Paulo State in Brazil and titled "*Reducing the uncertainty of*

- The contractual amount of LFG to be flared is among the relative amount of the top 20% of the landfills operated in Brazil.
- There are no electricity generation at the landfill using LFG as gaseous fuel over baseline recovery level[25].

The application of the latest version of the methodological tools "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (version 1) and "Tool to calculate the emission factor for an electricity system" (version 4) represents the commonly applied approach for determining baseline project and/or leakage emissions due to the consumption of grid-sourced electricity by the project activity.

The application of the latest version of the methodological tool "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 2) represents the commonly applied approach for determining baseline project and/or leakage emissions due to the consumption of fossil fuel by project activities (for use other than for electricity generation).

The application of the latest version of the methodological tool "Emission from solid waste disposal sites" (version 6.0.1) represents a more recent and appropriate approach for ex-ante estimation of emission reductions of project activities promoting destruction and/or utilization of LFG.

The application of the latest version of the methodological tool "Project emissions from flaring" (version 02.0.0) represents a more recent and appropriate approach for determine project emissions from flaring.

Additionally, it is important to note that AMC landfill is operated with all required licences and under compliance with all requirements set by its operating permit. This is required by applicable environmental regulations in Brazil. It should be noted that the AMC landfill has obtained ISO 9000 and ISO 14.000 certification for its quality and environment management systems.

The occurred permanent post-registration change in the project design for the project activity (which is related to the consumption of Liquefied Petroleum Gas (LPG) by the project activity) does not affect the applicability and application of AM0002 (version 1). The scale of the project activity is also not affected by such change either. The project activity remains being a large-scale project activity.

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methane recovered (R) in greenhouse gas inventories from waste sector and of adjustment factor (AF) in landfill gas projects under the Clean Development Mechanism", the document issued by the Administration of the Municipality of Salvador (municipal authority) confirms that the established contractual amount of LFG to be flared is among the relative amount of the top 20% of the landfills operated in Brazil. The findings of the study "*Magalhães, GHC.; Alves, J.W.S.; Santo Filho. F.; Kelson, M. Reducing the uncertainty of methane recovered (R) in greenhouse gas inventories from waste sector and of adjustment factor (AF) in landfill gas projects under the Clean Development Mechanism"* thus justify the applicability of the AM00002 on an ex-post basis. This technical paper, which was issued on 27/05/2010 is webhosted at the website of CETESB (the environmental authority for São Paulo State in Brazil):
http://www.cetesb.sp.gov.br/userfiles/file/mudancasclimaticas/biogas/file/docs/artigos_dissertacoes/magalhaes_alves_santofilho_costa_kelson.pdf

[25] For sake of completeness and transparency, Appendix 3 includes a comprehensive description of the occurred implementation of an electricity generation facility (using collected LFG as gaseous fuel) as part of the project activity which is valid for the 2nd 7-year renewable crediting period (which is thus not encompassed by this version of the PDD valid for already expired 1st 7-year crediting period). As per applicable CDM rules, the occurred inclusion of this electricity generation facility is to be addressed as a permanent post-registration change in the project design by making applicable changes in the yet to be registered PDD which will be valid for the 2nd 7-year renewable crediting period.

B.3. Project boundary

Generation of municipal solid waste (MSW) that has been disposed at the AMC landfill occurs locally, within the boundary of the country. The project boundary of the project activity includes the site where the LFG is captured and destroyed by combustion in enclosed high temperature flare(s). The system boundary is defined as the electricity grid that supplies the electricity to be consumed by the project activity (National Electricity Grid of Brazil).

The table below provides a summary of the delineation of greenhouse gases (GHG) and sources included and excluded from the project boundary:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario[26]	Emissions from decomposition of waste at the SWDS site.	CO_2	No	CO_2 emissions from decomposition of organic waste are not accounted since the CO_2 is also released under the project activity.
		CH_4	Yes	The major source of emissions in the baseline.
		N_2O	No	N_2O emissions are very small when compared to CH_4 emissions from SWDS (in tCO_2e). This is conservative.
Project scenario	Emissions from consumption of LPG by the project activity	CO_2	Yes	May be an important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small. It is important to note that residual CH_4 emission due to the combustion of LFG in enclosed flares are considered in the context of the determination of baseline emissions.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from consumption of grid electricity by the project activity	CO_2	Yes	May be an important emission source.
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

The schematic flow diagram below summarizes the project boundary and delineates the project activity (equipment, parameters to be monitored, and GHG included in the project boundary).

[26] While the project design does not encompass any utilization of collected LFG (as gaseous fuel for electricity generation and/or as gaseous fuel for heat generation and/or displacement of natural gas), baseline emissions for such utilization of LFG are thus not considered in the delineation of the GHG and applicable GHG sources considered and not considered from the project boundary. Such emission sources are thus not even presented in the related table.

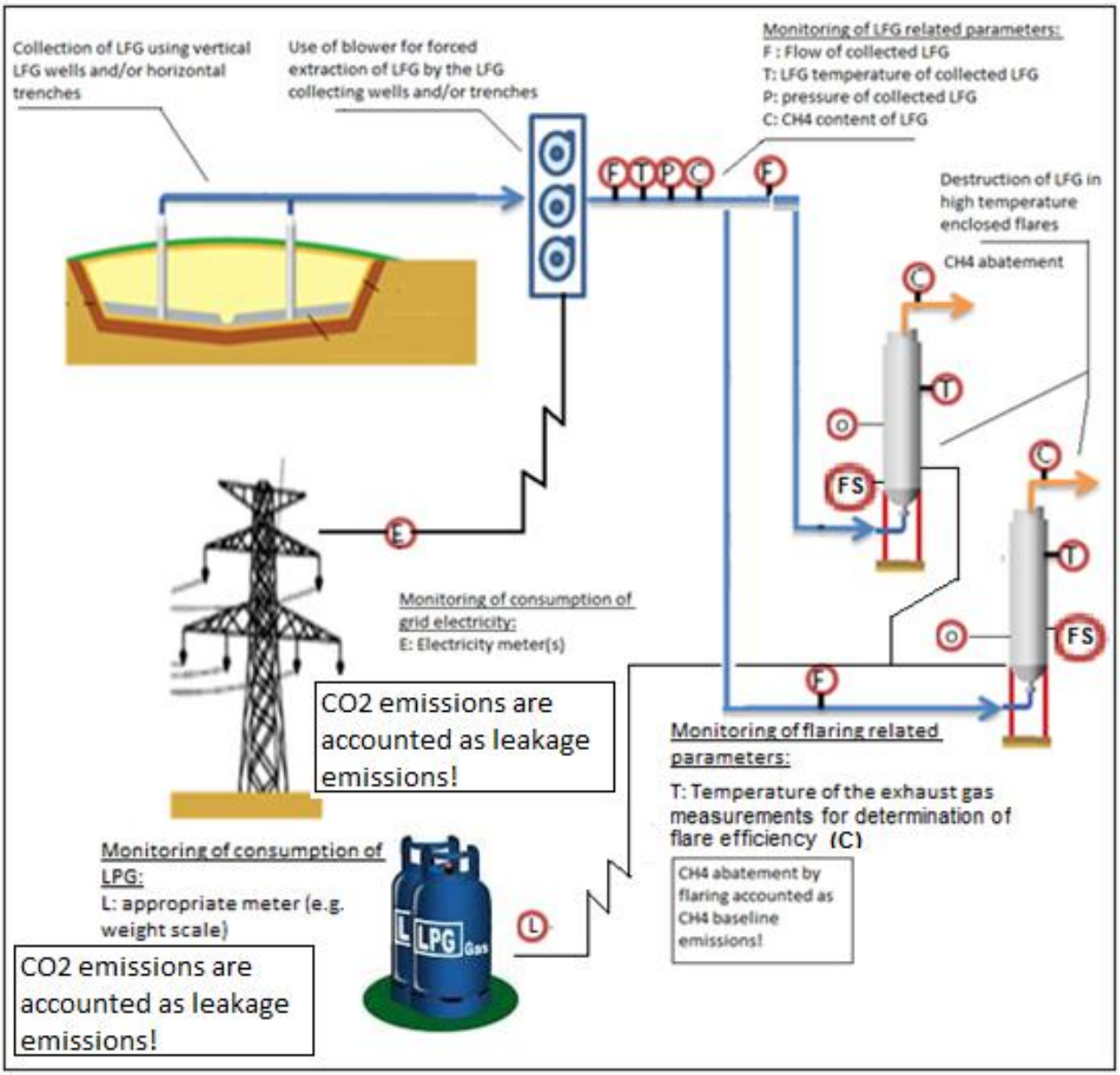

Figure 7 - Schematic flow diagram: delineation of the project boundary for the project activity

B.4. Establishment and description of baseline scenario[27]

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As defined by AM0002 (version 1), the selection of baseline scenario for the project activity is relatively straightforward. There are a pre-project contractual document, namely BATTRE's original technical proposal, which set between BATTRE and the Municipality of Salvador + a complementary clarification document issued by the Administration of the Municipality of Salvador (municipal authority) in 20/08/2010 governing the volume of methane gas to be captured at the AMC landfill. These legal documents cover the contractual lifetime of the landfill and define the amount of collected LFG that is required to be destroyed by combusted at the AMC landfill (regardless of the implementation of the project activity).

[27] This section includes texts related to the identification of the baseline scenario for the project activity + demonstration of additionality as presented in the previous version of the registered PDD (version 5 dated March 2005) with minor text improvements in order to enhance overall comprehension of description as well as to correct previously existent typo and grammar mistakes.

Typical recovery of methane or biogas in Brazil is minimal and there is no regulatory requirement governing its recovery. There is no national framework governing landfill practice and only technical norms issued by the Brazilian Association of Technical Norms (ABNT) without any technical requirement on LFG management.

As indicated in the approved methodology,

> *"If the actual quantity of methane flared is greater than the baseline quantity flared, the project activity is additional. The emissions reductions will be zero if the project activity is not additional.*
> *Since the baseline quantity flared is determined by the contractual requirement, which is established through a competitive bidding process the baseline reflects what would occur in the absence of the project activity."*

Additional considerations:
Why the emission reductions will not occur in the absence of the proposed project activity?

Local context at Salvador Landfill

Landfill contract barriers to investment:
The call for tender 004/99 launched in 1999 by Salvador Municipality established a maximum price to be paid for MSW landfilling activity: 16.69 R$/ton of disposed MSW (5.6 US$/ton).
The winning price (that BATTRE has proposed) was 15.86 R$/ ton (5.3 US $/ ton). That price included landfill design, licensing, construction, operation and an aftercare period of 20 years after landfill closure, during while BATTRE will have to maintain installation and treat all leachates to be produced. Within that very restrictive economical context, and by also taking into account that there was no specific requirement on gas management, BATTRE has calculated a volume - and associated investment and O&M cost - of landfill gas susceptible to be flared, compatible with its proposed price for the landfill activity. It is not included in the signed contract an additional remuneration for BATTRE implementing a better LFG management than required as per the signed contract.
For that reason, any investment or operational cost required to destroy LFG at the AMC landfill in a quantitative and qualitative level which is higher than required as per the signed contractual agreement between BATTRE and the Admistration of the Municipality of Salvador is additional as BATTRE will not have any remuneration/revenues other than CDM revenues (due to the commercialization of CERs to be generated by the project activity).
In baseline study, it was estimated that total accumulated costs for the project activity was of 45 Million of BRL. This total accumulated cost covers investments and cost to occur during the period from 2003 to 2019 (incl. capital investment in new flares, and LFG capture system, operational cost (e.g. consumption of grid-sourced electricity for pumping LFG, costs for maintenance of the LFG collection network, labour, etc).

Potential utilization of collected LFG as gaseous fuel for electricity generation (during the whole 1st 7-year renewable crediting period):

1. As part of the project design valid for the 1st 7-year renewable crediting period, electricity generation using collected LFG as gaseous fuel is not considered.
   At the time of the project design intitial conceptualization, it was concluded that, although in a first view electricity generation using landfill gas as gaseous fuel could be perceived as technology that represents an economically attractive course of action; it was not economically and technically attractive at that time. Studies carried by BATTRE at that time show that average required capital investment would at that time reach 900 US$/kW of installed capacity, with average operational cost around 12 US$/kWh. Moreover, technical risk on gas quality and regular quantity availability was considered as high. Such elements lead to a minimum price for selling of generated electricity of 0.150 R$/kWh in order to make electricity generation using collected LFG economically attractive. At the time of the project's initial design conceptualization, market price range for commercialization of generated electricity by

power producers in Brazil was between 0.045 R$/kWh to 0.080 R$/kWh. At that time, these figures made electricity generation using landfill gas as gaseous fuel being perceived as not competitive by itself. Also at the time of the project design initial conceptualization, grid-sourced electricity purchasing price at Salvador Landfill was about 0.180 R$/kWh. Such electricity tarrif could turn electricity generation for self-utilisation (meeting electricity demand for the project activity and demand for the AMC landfill) potentially economically attractive in a first view. However, total projected capacity required to meet the site electricity demand only was identified to be around 300 kW. However, generating electricity under this installed capacity range would require less than 5% of contractual volume of gas to be captured in 2004.

The proposed CDM project activity promotes real, measurable, verifiable net GHG emission reductions due to destruction of methane promoted by the implementation and operation of an efficient forced active LFG collection and destruction system at the AMC landfill. The contractual obligation of BATTRE with the Administration of the Municipality of Salvador (municipal authority) in terms of LFG collection and destruction, as stipulated in the more recently issued document (dated 20/08/2010) applicable in the context to the concession agreement previously between the Municipality of Salvador da Bahia and BATTRE, defines set of values for annual quantitative minimum amount of methane are assumed as required to be collected and destroyed at the AMC landfill during the period from year 2005 to year 2010. The currently implemented CDM project activity promotes LFG collection and destruction under a level significantly higher than established in the previously set contractual agreement.

National and sectoral policies and practices related to MSW disposal and treatment:
At the time of the project initial design conceptualization, the generation of MSW was estimated to be 228,413 ton/day in Brazil (source: IBGE, National Survey on Basic Sanitation, 2000), with a variable regional composition. The average amount of MSW generated per-capta varies from 0.4 to 0.9 kg/person/day in different regions of Brazil. Final disposal and treatment practices for collected MSW around the country represented the following practices:

- 60% of total collected MSW disposed at uncontrolled open localities (termed "*lixões*" in Brazilian Portuguese) or at landfills with simplified design and control,
- 36% of total collected MSW disposed in sanitary landfills
- 3% of total collected MSW treated in composting plants,
- 1% of total collected MSW treated in sorting plants and
- 0.4% of total collected MSW is combusted.

At the time of the project design initial conceptualization, typical recovery of methane or biogas was minimal and there was no regulatory requirement governing its recovery.

As established in AM0002 (version 1), a conservative estimate of 20% recovery of methane gas for passive systems has been considered as the best practice, based on a waste management industry benchmark and BATTRE's extrapolation of the results of the latest SITA research into this topic. (Source: "*measurement of biogás flow through different final cover at the Montebelluna Landfill – Italy*" – SITA/INERIS – December 2001). A new waste management policy ("*National Politic for Solid Waste*") has been under discussion for many years but currently no changes are anticipated to the existing national policy.

At the time of the project design initial conceptualization, there was therefore no national framework governing landfill practice and only technical norms issued by the Brazilian Association of Technical Norms (ABNT) without any technical requirement on LFG management.

A study issued by the Brazilian Bureau of Statistics IBGE about basic sanitation for State of Bahia shows that in 2000, 60% of MSW was treated in inappropriate site or with simple control, and 39.4 % in sanitary landfills. (Source: www.ibge.gov.br).

The occurred permanent post-registration change in the project design for the project activity (which is related to the consumption of LPG by the project activity) does not compromise or

promotes a negative adverse impact over the previously derived baseline scenario and also previously demonstrated additionality for the project activity. Consumption of LPG (which does not replace any other fuel) merely represents an additional/incremental operating cost for the project activity. Moreover, related GHG emissions due to the consumption of LPG are accounted as leakage emissions in the context of determination of emission reductions achieved by the project activity.

B.5. Demonstration of additionality

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The additionality of the project activity is demonstrated in Section B.4[28].

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Annual emission reductions achieved by the project activity are determined as the difference between annual baseline emissions (ER_y[29]) and annual leakage emissions (LE_y).

Determination of Baseline Emissions:

In accordance with AM0002 (version 1) and by also taking to consideration ex-post determined value(s) for methane combustion efficiency of the flares (FE), baseline emissions (ER_y) are determined as follows:

$ER_y = ER\_CH4_y * CF * GWP\_CH4$

Where:

CF Conversion factor density. CF is ex-ante determined as 0.0007168 ton $CH_4/m^3 CH_4$

[28] It is important to note that, at the time the previous version of the registered PDD (version 5, dated March 2005) was compiled and was assessed/approved by both the DOE in charge of the CDM validation of the project activity and by the CDM-EB (by years 2003 and 2004 respectively), the existent rules for (i) completing the CDM-PDD form, (ii) deriving the baseline scenario and (iii) demonstrating additionality for the project activity were not as detailed and well-structured as the currently valid related rules. When compiling the previously revised version of the PDD (version 6, dated 27/12/2013) for addressing occurred post-registration changes (about 10 year after the compilation of the previous version of the registered PDD) the project participant BATTRE and its associated CDM consultants faced strong difficulties on converting information made available in the previous PDD (which is dated 2005 and applies an initial and not even official CDM-PDD form) to the latest version of the CDM-PDD form at the time (version 04.1) (as required by applicable rules and procedures for addressing post-registration changes). In the particular case of information related to the description/identification of baseline scenario and demonstration of additionality for the project activity, information related to these both issues were presented somehow all together in the previous version of the registered PDD. In order to maintain the desired integrity and originality of such information, the project participant BATTRE took the decision to compile this revision of the PDD performing changes in the original text under a minimum level. Due to that, the whole demonstration of additionality of the project activity is reported based on its original text in Section B.4 of both revised versions of the PDD (versions 6 and 7) (and not under Section B.5).

[29] While AM0002 (version 1) does not take into consideration leakage emissions for the determination of emission reduction achieved by the project activity, emission reductions are determined as equivalent to baseline emissions by the methodological approach applied by this CDM baseline and monitoring methodology. In this context the symbol “ERy” is hereby considered for baseline emissions.

GWP_CH4 Global Warming Potential (GWP) of methane. GWP_CH4 is ex-ante determined as 21 tCO_2e/ tCH_4 (default value)

ER_CH4_y Methane emission reduction (in m^3 of CH_4), where:

$$ER\_CH4_y = CH4_{flared,y} * FE - CH4_{baseline,y}$$ [30]

Where:

$CH4_{flared,y}$ Quantity of methane actually flared (in m^3 of CH_4). In accordance both with AM0002 (version 1) and project design, $CH4_{flared,y}$ is determined as part of the operation of the project activity on the basis of (i) continuous measurements of flow of collected LFG which is sent to the high temperature enclosed flares and (ii) continuous measurements of fraction of methane in the collected LFG. The ex-ante determined value for density of methane (parameter CF) is also considered for also reporting values for $CH4_{flared,y}$ in tCH_4 [31]

FE Flare efficiency

Consideration of ex-post determined value(s) for methane combustion efficiency of the flares (FE) for the calculation of ER_CH4_y[32]

AM0002 (version 1) explicitly establishes that "*the methane content of the flare emissions will be analyzed quarterly" (…)* "*lab analysis 4 times/year*"[33]. While this is not indeed reflected in the formulae for calculating $ER\_CH_{4,y}$ a presented in AM0002 (version 1), the total volume of methane collected and destroyed in the flares ($CH4_{flared}$) is thus adjusted by also considering the monitored value of FE[34]

Determination of FE values:

In order to determined FE values, a third-party inspection service company should periodically perform the following tasks:

[30] Also see "Consideration of ex-post determined value(s) for methane combustion efficiency of the flares (FE) for the calculation of ER_CH4_y" below

[31] While as per AM0002 (version 1), the accumulated value of the monitoring parameter $CH4_{flared,y}$ is to be reported in tCH_4, the calculation procedure for baseline emissions in both registered PDD and AM0002 (version 1) requires the accumulated value of the monitoring parameter $CH4_{flared,y}$ to be accounted in Nm^3 of CH_4. Due to that, values are to be reported in both units (by considering the ex-ante determined value of CH4 density (parameter CF).

[32] The consideration of an appropriate approach for determining project emissions from residual methane emissions due to flaring of LFG by the project activity (based on monitoring the CH_4 combustion efficiency in the project's high temperature enclosed flares) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices) was addressed in the previously revised version of the PDD (version 6, dated 27/12/2013) as a post-registration change (under the category "permanent change in the monitoring plan from the registered PDD"). Post-registration changes encompassed by version 6 of the PDD are also summarized in Appendix 6.

[33] As per the previous registered version of the PDD (version 5 dated March 2005), ex-post determined values for methane combustion efficiency of the flares (FE) are not required to be taken into account for the determination of ER_CH4_y. The consideration of ex-post determined values for methane combustion efficiency of the flares (FE) thus represent a post-registration change to the project activity.

[34] While the fornulae was corrected in the updated version of AM0002 (version 2), for sake of correctness the formulae of AM0002 (version 2) which includes the term "$CH4_{flared,y}$ * FE" instead of "$CH4_{flared,y}$" is used in the context of the emission reduction calculations.

- (a) appropriate measurements of residual concentration
- of methane in sample the exhaust gas of the flares
- (b) appropriate determination of flow of exhaust gas in the flares
- (c) perform the calculations of values of FE based on (a) and (b)[35]

In accordance with AM0002 (version 1) requirement, the test/evaluation was performed 4 times per year.

$CH4_{baseline,y}$ Quantity of methane that would be flared in the absence of the project activity in baseline scenario (as adjusted with eventual differences of quantity of disposed MSW and methane content) (in m^3 of CH_4). As per the monitoring and calculation approach applied by the project activity, $CH4_{baseline,y}$ is determined as follows:

$$CH4_{baseline,y} = CH4_{contract,y}$$

Where:

$CH4_{contract,y}$ Quantity of methane that would be flared in the absence of the project activity in baseline scenario as defined by the contractual agreement (in m^3 of CH_4)[36].

[35] The monitoring plan of the registered PDD does not include any reference about how to perform the related measurement and how to actually calculate the values of FE. AM0002 (version 1) merely establishes that "*the methane content of the flare emissions will be analyzed quarterly*".

[36] While as per AM0002 (version 1), the value of the monitoring parameter $CH4_{contract,y}$ is to be reported in tCH_4, the calculation procedure for baseline emissions in both registered PDD and AM0002 (version 1) requires the value of the monitoring parameter $CH4_{contract,y}$ and calculation parameter $CH4_{baseline,y}$ to be both accounted in Nm^3 of CH_4. Due to that the monitored values for $CH4_{contract,y}$ and the calculated value for $CH4_{baseline,y}$ are to be presented in both units (by considering the ex-ante determined value of CH_4 density (parameter CF).

Use of a more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario [37]

As per AM0002 (version 1), $CH4_{baseline,y}$ is determined as follows:

$CH4_{baseline,y} = CH4_{contract,y} * WASTE_{actual,y} / WASTE_{contract,y} * (CH4/LFG_{actual}) / (CH4/LFG_{contract})$

Where:

$CH4_{contract,y}$ Quantity of methane to be flared (regardless of the project activity) as established by contractual requirements set between BATTRE and the Administration of the Municipality of Salvador (in tCH_4)[38].

$WASTE_{actual,y}$ Quantity of waste actually disposed at the landfill during the year encompassed by the considered monitoring period.

$WASTE_{contract,y}$ Reference quantity of waste projected to be disposed at the AMC landfill as per contractual requirements set between BATTRE and the Administration of the Municipality of Salvador. $WASTE_{contract,y}$ is ex-ante determined as 870,000 ton.

$CH4/LFG_{actual}$ Annual calculated weighted average methane content in landfill gas during the year encompassed by the considered monitoring period.

$CH4/LFG_{contract}$ Reference weighted average methane content in landfill gas as per contractual requirements set between BATTRE and the Administration of the Municipality of Salvador. $CH4/LFG_{contract}$ is ex-ante determined as 50%

As per the determination approach valid for the project activity (due to related monitoring aspects) , the following notes are relevant:

Note 1: For the determination of the calculated value of $CH4_{baseline,y}$, the ratio *"$(CH4/LFG_{actual}) / (CH4/LFG_{contract})$"* is assumed as equal to 1. AM0002 requires that the ratio *"$(CH4/LFG_{actual}) / (CH4/LFG_{contract})$"* is to be only considered in the context of the determination of $CH4_{baseline,y}$ in cases where the result of ratio is higher than 1 ($CH4/LFG_{actual} > CH4/LFG_{contract}$), otherwise a not valid/inconsistent value for $CH4_{baseline,y}$ is resulted.

[37] The use of a more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario (absence of the project activity) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices) was addressed in the previously revised version of the PDD (version 6, dated 27/12/2013) as a post-registration change (under the category "permanent change in the monitoring plan from the registered PDD"). This needed change is based on applicable contractual requirements and data/information made available by the Administration of the Municipality of Salvador (municipal authority). By applying such revised monitoring approach, it is assumed that the quantitative value for the parameter $CH4_{baseline,y}$ is equal to the value for the monitoring parameter $CH4_{contract,y}$ for each year of the crediting period.

[38] It is noteworthy that while AM0002 (version 1) requires $CH4_{contract,y}$ to be determined in mass basis (in tCH_4), the calculation approach for $CH4_{baseline,y}$ requires the value for $CH4_{contract,y}$ to be considered in volume basis (in m^3 of CH_4). This represents a minor limitation/inconsistency of AM0002 (version 1).

Note 2: For the determination of the calculated value of $CH4_{baseline,y}$, the ratio "$WASTE_{actual,y}$ / $WASTE_{contract,y}$" is also assumed as equal to 1 due to related monitoring aspects. The rationale/justification for such assumption is explained in the items below:
Like the rationale applicable for the ratio "*(CH4/LFG$_{actual}$) / (CH4/LFG$_{contract}$)*" (as explained above), calculating $CH4_{baseline,y}$ by considering the ratio "$WASTE_{actual,y}$ / $WASTE_{contract,y}$" as equal to 1.00 represents the most appropriate, correct and conservative approach in the particular context of the project activity.
While annual values for $CH4_{contract,y}$ for years encompassed by the period from 2005 to 2010 were defined/established by the Administration of the Municipality of Salvador (municipal authority) by *inter alia* taking into account reported records of CH_4 volume which were actually collected and destroyed during the period 2005-2010, value for $CH4_{contract,y}$ were thus already determined as a function of the amount of LFG and methane actually generated and collected in the project site. As the LFG generation (and its CH_4 content) are defined/influenced *inter alia* by the amount of MSW historically disposed in the LFG and MSW composition, it is thus assumed that the amount of MSW actually disposed in the AMC landfill during the period from 2005 to 2010 (and also amount of MSW disposed in previous years) are already being adequately considered in the determination of $CH4_{baseline,y}$. Thus the requirement of AM0002 of calculating $CH4_{baseline,y}$ as a function of the calculated value of the ratio "*$WASTE_{actual,y}$ / $WASTE_{contract,y}$*" is thus not appropriate vis-à-vis the implemented monitoring system and practice.

Finally, despite of the considerations above, it is crucial to note that by applying the ratio of value of the ratio "*$WASTE_{actual,y}$/$WASTE_{contract,y}$*" for each year of crediting period in the context of the determination of annual values of $CH4_{baseline,y}$, paradoxically represents assuming that all incremental MSW disposed in a given year (beyond the ex-ante defined values for each year of 870,000 ton) would be entirely anaerobically decomposed in such year (thus generating additional amount of LFG only during the considered year).
BATTRE highlights such methodological assumption is currently regarded as not correct and appropriate as MSW anaerobic decomposition in any landfill (such as the AMC landfill) takes time which is normally longer than one year (timing actually depends on ambient conditions, MSW composition, landfilling conditions, etc.).

Thus, $CH4_{baseline,y} = CH4_{contract,y}$

Appendix 3 includes detailed methodological explanations for not considering the specific provisions of AM0002 for determining $CH4_{baseline,y}$ and applying a more appropriate approach for determining ex-post annual values for the monitoring parameter "Amount of methane destruction in the absence of the project activity as per contractual agreement" ($CH4_{contract,y}$). As further explained and summarized in Appendix 3 and Appendix 6 respectively, the previously revised version of the PDD (version 6, 27/12/2013) addresses issues related to the potential non-fully compliance with all applicability conditions of AM0002 (version 1) and the use of a more appropriate approach for determining ex-post annual values for the monitoring parameter $CH4_{contract,y}$ as post-registration changes.

Determination of Project Emissions:

Not applicable.

GHG emissions due to the consumption of both grid-sourced electricity and LPG (fossil fuel used for starting up the flares) by the project activity are regarded and accounted as leakage emissions as required by AM0002 (version 1). Moreover, residual methane emissions due to the efficiency of the enclosed flares are considered in the context of the baseline emission calculations.

Determination of Leakage Emissions:

Associated GHG emissions due to consumption of grid-sourced electricity and fossil fuel (LPG) by the project activity are accounted as leakage emissions.

Leakage emissions in year *y* (LE_y) are calculated (in tCO_2/yr) as follows:

$$LE_y = LE_{EC,grid,y} + LE_{FC,LPG,y}$$

Where:

$LE_{EC,grid,y}$	Leakage emissions due to the consumption of electricity by the project activity in year *y* (in tCO_2/yr)
$LE_{FC,LPG,,y}$	Leakage emissions due to the consumption of fossil fuel LPG by the project activity (for purpose other than electricity generation) in year *y* (in tCO_2/yr)

Details about the determination of $LE_{EC,grid,y}$ and $LE_{FC,LPG,y}$ are presented below:

Leakage emissions due to the consumption of grid-sourced electricity by the project activity ($LE_{EC,grid,y}$)

Leakage emissions due to the consumption of grid-sourced electricity by the project activity *($LE_{EC,grid,,y}$)* are calculated by following the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" with the following observations[39]:

$$LE_{EC,grid,y} = EC_{grid,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$$

Where:

$EC_{grid,y}$	Quantity of grid-sourced electricity consumed by the project activity in year *y* (in MWh).
$TDL_{grid,y}$	Average technical transmission and distribution losses in the National Grid of Brazil in year *y*.
$EF_{EL,grid,y}$	Emission factor for grid electricity generation in year *y* (in tCO_2/MWh). The project activity will consume electricity sourced by the National Electricity Grid of Brazil. This grid is locally denominated *Sistema Interconectado Nacional (SIN)* (Brazilian Interconnected System). The DNA of Brazil has published the delineation of SIN grid to be adopted for the purposes of CDM projects. As per Resolution Nº8 of the DNA of Brazil, the connected electricity system to be considered in this project activity is considered as a single system consisted by the sub-markets of SIN as the definition of the electric system of the project. As established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", $EF_{EL,grid,y}$ is calculated ex-post as the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) for the SIN grid by following the applicable

[39] As summarized in Appendix 6, the previously revised version of the PDD (version 6, dated 27/12/2013) addressed as a permanent change in the monitoring plan the use of a more appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of grid-sourced electricity by the project activity (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices).

guidance of the latest version of the "Tool to calculate the emission factor for an electricity system". The following equations are applicable for the determination of $EF_{grid,CM,y}$:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where:

$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

Annual official values for $EF_{grid,OM,}$ and $EF_{grid,BM,y}$ are regularly calculated and published by the DNA of Brazil (Brazilian Inter-ministerial Commission for Global Climate Change). As per information made publicly available by the DNA of Brazil for years 2006 to 2013, such official values for $EF_{grid,OM,}$ and $EF_{grid,BM,y}$ are calculated in full accordance with the most recent version of the "Tool to calculate the emission factor for an electricity system".

The weighting factors for build and operating margin were selected according to guidance provided in the "Tool to calculate the emission factor for an electricity system". $EF_{grid,OM,y}$ will be calculated by applying calculation guidance of the methodological tool applicable for *dispatch data analysis OM*. Under this calculation method, data for the year in which the project activity consumes grid-sourced electricity is considered for determining emission factor annually during monitoring. As per this method $EF_{grid,OM,y}$ is determined based on the grid power units that are actually dispatched at the margin during each hour *h*. $EF_{grid,OM,y}$ is calculated (in tCO_2/MWh) as the dispatch data analysis operating margin CO_2 emission factor in year *y* ($EF_{grid,OM-DD,y}$).

For the first crediting period, the build margin CO_2 emission factor will be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available.

Leakage emissions due to the consumption of LPG by the project activity:

Leakage emissions due to the consumption of LPG by the project activity are determined by applying applicable guidance of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (version 02) as follows[40]:

$LE_{FC,LPG,y} = FC_{LPG,y} * COEF_{LPG,y}$
Where:

[40] As summarized in Appendix 6, the previously revised version of the PDD (version 6, dated 27/12/2013) addressed as a permanent change in the monitoring plan the use of an appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of fossil fuel LPG by the project activity (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices). As also summarized in Appendix 6, the consumption of LPG by the project activity for igniting the installed high temperature enclosed flares (after temporary planned or unplaned interruptions of operation of the flares) is also ackowledged to represent an occurred permanent changes in the design of the project activity.

$FC_{LPG,y}$ Quantity of fuel LPG combusted by the project activity

$COEF_{LPG,y}$ Conversion emissions factor for fossil fuel LPG. The Emission factor for LPG ($COEF_{LPG,y}$) is determined as the product between Net calorific value for fossil fuel LPG ($NCV_{LPG,y}$) and CO_2 emission factor for fossil fuel LPG ($EF_{CO2,LPG,y}$).

B.6.2. Data and parameters fixed ex ante

Ex-ante determined parameters required for determining baseline emissions:

Data / Parameter	**$WASTE_{contract,y}$**
Unit	ton
Description	Reference quantity of waste projected to be disposed at the AMC landfill as per contractual requirements set between BATTRE and the Administration of the Municipality of Salvador (municipal authority).
Source of data	Defined as per as per contractual requirements set between BATTRE and the Administration of the Municipality of Salvador (municipal authority).
Value(s) applied	870,000
Choice of data or Measurement methods and procedures	-
Purpose of data	As per AM0002 (version 1), $WASTE_{contract,y}$ is applied for the determination of the quantity of methane flared at the baseline scenario ($CH4_{baseline,y}$) as a function of the quantity of methane flared at the baseline scenario as established under the contractual agreement ($CH4_{contract,y}$). It is however crucial to note that in the context of the applied more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario [41], the ex-ante determined value for $WASTE_{contract,y}$ is not taken into account. Anyway, for sake of completeness, this ex-ante determined parameter is kept in the list of ex-ante determined parameters.
Additional comment	-

[41] The use of a more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario (absence of the project activity) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices) was addressed in the previously revised version of the PDD (version 6, dated 27/12/2013) as a post-registration change (under the category "permanent change in the monitoring plan from the registered PDD"). This needed change is based on applicable contractual requirements and data/information made available by the Administration of the Municipality of Salvador (municipal authority). By applying such revised monitoring approach, it is assumed that the quantitative value for the parameter $CH4_{baseline,y}$ is equal to the value for the monitoring parameter $CH4_{contract,y}$ for each year of the crediting period.

Data / Parameter	**$CH4/LFG_{contract}$**
Unit	-
Description	Reference weighted average methane content in landfill gas as per contractual requirements set between BATTRE and the Administration of the Municipality of Salvador.
Source of data	Defined as per as per contractual requirements set between BATTRE and the Administration of the Municipality of Salvador (municipal authority).
Value(s) applied	50%
Choice of data or Measurement methods and procedures	-
Purpose of data	As per AM0002 (version 1), $CH4/LFG_{contract}$ is applied for the determination of the quantity of methane flared at the baseline scenario ($CH4_{baseline,y}$) as a function of the quantity of methane flared at the baseline scenario as established under the contractual agreement ($CH4_{contract,y}$). It is however crucial to note that in the context of the applied more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario [42], the ex-ante determined value for $CH4/LFG_{contract}$ is not taken into account. Anyway, for sake of completeness, this ex-ante determined parameter is kept in the list of ex-ante determined parameters.
Additional comment	-

Data / Parameter	**GWP_CH4**
Unit	tCO_2/tCH_4
Description	Global Warming Potential value for methane.
Source of data	-
Value(s) applied	21

[42] The use of a more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario (absence of the project activity) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices) was addressed in the previously revised version of the PDD (version 6, dated 27/12/2013) as a post-registration change (under the category "permanent change in the monitoring plan from the registered PDD"). This needed change is based on applicable contractual requirements and data/information made available by the Administration of the Municipality of Salvador (municipal authority). By applying such revised monitoring approach, it is assumed that the quantitative value for the parameter $CH4_{baseline,y}$ is equal to the value for the monitoring parameter $CH4_{contract,y}$ for each year of the crediting period.

Choice of data or Measurement methods and procedures	Default as per AM0002 (Version 01). Note: Since this PDD is valid only for the 1st 7-year renewable crediting period (which was finalized in 31/12/2010), the GWP value applicable for the 1st commitment period of the Kyoto Protocol is selected.
Purpose of data	Value is applied for the determination of baseline emissions.
Additional comment	-

Data / Parameter	**CF**
Unit	ton/m^3
Description	Conversion factor.
Source of data	Approved/published baseline and monitoring methodologies and methodological tools: - ACM0001 (version 11), (more recent versions of ACM0001 refers to the tools indicated below for value of methane density); - "Project emissions from flaring" (Version 02.0.0); - "Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 2.0.0)".

<table>
<tr><td>Value(s) applied</td><td>0.0007168</td></tr>
<tr><td>Choice of data or Measurement methods and procedures</td><td>CF corresponds to density of methane (CH_4).

The previous applicable default value for CF (as set by AM0002 (Version 1.0)) was 0.00062 ton/m^3 . The following is explicitly indicated in all versions of AM0002 (versions 1, 2 and 3):
“(…)
Conversion Factor[1]

<table>
<tr><td>Factor</td><td>Unit</td><td>Period Applicable</td><td>Description/Source</td></tr>
<tr><td>0.000662</td><td>ton CH_4/m^3(STP) CH_4</td><td>Default</td><td></td></tr>
</table>
1) This table is updated as more scientific information becomes available or reporting guidelines are modified.
(…)”

By following not only the above-quoted requirement of AM0002 to update and/or correct the value if applicable, but also currently valid applicable guidance of the CDM Project Cycle Procedure for addressing post-registration changes (corrections of values of ex-ante selected parameters), the value is updated/corrected by taking into account that the value of 0.0007168 ton/m^3. This value is defined as the appropriate value for density of methane gas (at normal (STP) conditions) by the following more recently approved/published CDM baseline and monitoring methodologies and CDM methodological tools:
- ACM0001 (version 11), (more recent versions of ACM0001 refers to the tools indicated below for value of methane density);
- “Project emissions from flaring” (Version 02.0.0);
- “Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 2.0.0)”, etc.)[43].</td></tr>
<tr><td>Purpose of data</td><td>Value is applied for the determination of baseline emissions.</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

[43] The post-registration changes encompassed by both revised versions of the PDD (versions 6 and 7) are summarized in Appendix 6.

Ex-ante determined parameters required for determining leakage emissions due to the consumption of grid-sourced electricity by the project activity[44]:

Data / Parameter	$TDL_{grid,y}$
Unit	-
Description	Transmission and distribution losses for electricity generation in the National Electricity Grid of Brazil.
Source of data	Applicable default as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (Version 01).
Value(s) applied	20%
Choice of data or Measurement methods and procedures	-
Purpose of data	Data is used for the determination of leakage emissions (due to consumption of grid-sourced electricity by the project activity).
Additional comment	-

Data / Parameter	w_{BM}
Unit	%
Description	Weighting of build margin emissions factor.
Source of data	Applicable default value as per the "Tool to calculate the emission factor for an electricity system" (version 03.0.0).
Value(s) applied	0.50 (50%) during the 1st 7-year crediting period.
Choice of data or Measurement methods and procedures	The applicable value as per the "Tool to calculate the emission factor for an electricity system" (version 3.0.0) is selected.
Purpose of data	Data is used for determination of leakage emissions due to the consumption of grid-sourced electricity by the project activity.
Additional comment	The ex-ante determined value for w_{BM} will be considered only in case the emission factor for grid-sourced electricity generation in year *y* ($EF_{EL,grid,y}$) is determined and calcutated as the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) as per the "Tool to calculate the emission factor for an electricity system".

[44] As summarized in Appendix 6, the previously revised version of the PDD (version 6, dated 27/12/2013) addressed as a permanent change in the monitoring plan the use of a more appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of grid-sourced electricity by the project activity (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices). In the context of the applied approach for determining such leakage emissions, the following ex-ante determined parameters are considered as established by applicable approach of the "Tool to calculate the emission factor for an electricity system" (version 3.0.0):

- Transmission and distribution losses for electricity generation in the National Electricity Grid of Brazil ($TDL_{grid,y}$)
- Weighting of build margin emissions factor (w_{BM})
- Weighting of operating margin emissions factor (w_{OM})

Data / Parameter	w_{OM}
Unit	%
Description	Weighting of operating margin emissions factor
Source of data	Applicable default value as per the "Tool to calculate the emission factor for an electricity system" (version 3.0.0).
Value(s) applied	0.50 (50%) during the 1st 7-year crediting period.
Choice of data or Measurement methods and procedures	The applicable value as per the "Tool to calculate the emission factor for an electricity system" (version 3.0.0) is selected.
Purpose of data	Data is used for determination of leakage emissions due to the consumption of grid-sourced electricity by the project activity.
Additional comment	The ex-ante determined value for w_{OM} will be considered only in case the emission factor for grid-sourced electricity generation in year *y* ($EF_{EL,grid,y}$) is determined and calcutated as the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) as per the "Tool to calculate the emission factor for an electricity system".

Ex-ante determined parameter applied only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity during the 1st 7-year crediting period:[45]

Data / Parameter	η_{PJ}
Unit	-
Description	Efficiency of the LFG capture system that will be installed in the project activity.
Source of data	Value obtained from recent technical literature.
Value(s) applied	0.9280

[45] The approach applied for calculating the ex-ante estimates of emission reductions was revised. As one of the post-registration changes (under the category "Corrections (that do not affect the project design)") which was addressed by the previously revised version of the PDD (version 6, dated 27/12/2013), the ex-ante estimations of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period were revised. This revision was due to the following aspects:

- Application of more accurate values for organic content and amount of Municipal Solid Waste (MSW) historically disposed at the AMC landfill;
- Use of more appropriate approach for estimating the amount of methane to be generated at the AMC landfill and to be collected by the project activity. Such estimations are performed by applying a more recent and appropriated approach as per the methodological tool "Emission from solid waste disposal sites" (version 6.0.1).
- Consideration of leakage emissions due to the consumption of both grid-sourced electricity and LPG by the project activity
- Consideration of the correct value for the ex-ante determined parameter CF (density of methane).

By taking into account the relative limitations of the methodological approach of AM0002 (version 1), the ex-ante estimate of methane generation at the AMC landfill is performed by applying applicable approach of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1). Such alternative approach promotes more accurate and correct estimates of emission reductions (without affecting the amount of baseline emissions to be determined ex-post as part of the application of the project's monitoring plan + applicable GHG calculations).

Choice of data or Measurement methods and procedures	Value obtained from the mentioned literature [46] by taking into consideration the design and operational characteristics/aspects of the AMC landfill and forecasted design of the project's LFG collection network.
Purpose of data	Data is used for determination of baseline emissions.
Additional comment	Selected value can also be represented as percentage, since 0.9280 = 92.80%.

Data / Parameter	
Unit	φ_y
Description	-
Source of data	Model correction factor to account for model uncertainties.
Value(s) applied	Applicable default value as per the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1).
Choice of data or Measurement methods and procedures	0.75
Purpose of data	Determined based on default value of table 3 of the referred methodological tool as per Option 1, Application A when determining the model correction factor.
Additional comment	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
	-

Data / Parameter	**OX**
Unit	-
Description	Oxidation factor (reflecting the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste))
Source of data	-
Value(s) applied	0

[46] The paper "*Measuring landfill gas collection efficiency using surface methane concentration*" by Raymond L. Huitric and Dung Kong, from the Solid Waste Management Department of the Los Angeles County Sanitation Districts, states that: *"Measuring landfill gas collection efficiency is important for gauging emission control effectiveness and energy recovery opportunities. Though researched for years, practical measures of collection efficiency are lacking. Instead, a default efficiency of 75% based on surveys of industry estimates is commonly used, for example, by the United States Environmental Protection Agency (US EPA). Though few, actual emission measurements indicate substantially higher efficiencies ranging from 85 to 98%".* This document mentions that *"(…) landfill gas collection efficiencies should routinely reach 100%."* Practical results, shown on table 4 of the study: Weighted average collection efficiency, show a collection efficiency of 92.8 to 96.1% on well-engineered landfills with vacuum systems to extract LFG. The present landfill is a well-engineered landfill as shown by the maximum classification obtained in IQR in 2009, 2010 and 2011 (Page 57 of the 2011 edition of the "*Inventário dos resíduos sólidos domiciliares*"), to evaluate landfill characteristics.
"*Measuring landfill gas collection efficiency using surface methane concentration*" is available at http://www.arb.ca.gov/cc/ccea/comments/april/huitric_kong.pdf, accessed on 10/10/2012, and *"Inventário dos resíduos sólidos domiciliares, 2011 edition"* was delivered to the DOE as part of the evidences of the validation process of the project activity.

Choice of data or Measurement methods and procedures	While the default value as per the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) is 0.1, it should be noted that differently than more recent versions of the CDM baseline ACM0001 – "Flaring or use of landfill gas", as per the approach of AM0002 (version 1) for determining emission reductions actually achieved by the project activity, there is no parameter that reflects the amount of methane from the considered SWDS that is oxidized in the soil (or other material covering the waste)) which is considered in related calculations. In the particular case of the more recent versions of ACM0001 (versions 12, 13, 14 and 15), as established by such CDM baseline and monitoring methodology, the default value for the ex-ante determined parameter $OX_{top\text{-}layer}$ is set as 0.1 and it is regarded as corresponding to the fraction of the methane that would oxidize in the top layer of the SWDS in the absence of the project activity. Also as per ACM0001, it is assumed that under the project activity, this effect is reduced since part of generated LFG is captured and does not pass through the top layer of the SWDS where it would be oxidized. Differently than the case of AM0002 (version 1), the application of the $OX_{top\text{-}layer}$ in the more recent version of ACM0001 reduces emission reductions determined as function of amount of methane effectively collected and destroyed/utilized in 10%. Thus, selecting the 0.1 value for parameter OX would promote a relative overestimation of ex-ante estimation of emission reductions to be achieved by the project activity. Thus, zero value is selected.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	-

Data / Parameter	**F**
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction of methane in the collected LFG).
Source of data	Applicable default value as per the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1).
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the considered SWDS. A default value of 0.5 is recommended by IPCC.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	-

Data / Parameter	$DOC_{f,default}$
Unit	-
Description	Fraction of degradable organic carbon (DOC) in MSW that decomposes in the considered SWDS.
Source of data	Applicable default value as per the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1), which refers to applicable value as per IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. The default value was applied as per Application A of the tool: "*The CDM project activity mitigates methane emissions from a specific existing SWDS".*
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	Application A as per the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) is the case of the current project activity.

Data / Parameter	$MCF_{default}$
Unit	-
Description	Methane correction factor.
Source of data	Value is sourced by the methodological tool "Emissions from solid waste disposal sites", that refers to IPCC 2006 Guidelines for National Greenhouse Gas Inventories.
Value(s) applied	1.0
Choice of data or Measurement methods and procedures	Value is selected as per Application A of the methodological tool, under the following conditions: "*1.0: for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste;"* The operations of the AMC landfill encompass utilization of appropriate covering material and mechanical compacting as part of the MSW disposal activities.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	-

Data / Parameter	DOC_j
Unit	-
Description	Fraction of degradable organic carbon (by weight) in the waste type *j.*

Source of data	Values are selected as per applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1), that refers to IPCC 2006 Guidelines for National Greenhouse Gas Inventories, (adapted from Volume 5, Tables 2.4 and 2.5).
Value(s) applied	

Waste type *j*	DOCj (% wet waste)
Wood and wood products	43
Pulp, paper and cardboard (other than sludge)	40
Food, food waste, beverages and tobacco (other than sludge)	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

Choice of data or Measurement methods and procedures	The selected values are based on wet waste basis (moisture concentrations in the waste streams as waste is delivered to the SWDS). The IPCC 2006 Guidelines also specify DOC values on a dry waste basis, which refers to the moisture concentrations after complete removal of all moisture from the waste. However, this is not believed practical for this situation.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	-

Data / Parameter	k_j
Unit	-
Description	Decay rate for the waste type *j.*
Source of data	Values are selected as per applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1), that refers to IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3). Source of data of Mean Annual Temperature (MAT) and Mean Annual Precipitation (MAP): Tempo Agora (http://www.tempoagora.com.br).
Value(s) applied	

Degradation speed	***Waste Type***	k_j
Slowly degrading	Wood, wood products	0.035
	Pulp, paper and cardboard (other than sludge)	0.07
	Textiles	0.07
Moderately Degrading	other (non-food) organic putrescible Garden, yard and park waste	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco	0.40

Choice of data or Measurement methods and procedures	Parameters are selected in accordance to the climate zone of the project site: Mean Annual Temperature (MAT) = 25 ^{o}C - Tropical climate Mean Annual Precipitation (MAP) = 2,1500 mm – Wet climate.
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	-

Data / Parameter	**W_j**
Unit	-
Description	Weight fraction of the waste type j
Source of data	Values are selected as per applicable guidance of IPCC 2006 Guidelines for National Greenhouse Gas, Volume 5, Chapter 2, tables 2.3-2.5, MSW composition regional default values for South-America.
Value(s) applied	
Choice of data or Measurement methods and procedures	-
Purpose of data	Data is used for the ex-ante estimation of the amount of methane destroyed by the project activity ($CH4_{flared,y}$). Data is utilized only in the context of the ex-ante estimation of emission reduction to be achieved by the project activity.
Additional comment	-

Waste type *j*	**W_j (% wet waste)**
Wood and wood products	4.7
Pulp, paper and cardboard (other than sludge)	17.1
Food, food waste, beverages and tobacco (other than sludge)	44.9
Textiles	2.6
Garden, yard and park waste	0.0
Glass, plastic, metal, other inert waste	30.7

B.6.3. Ex ante calculation of emission reductions

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Ex-ante estimation of emission reductions is determined in (tCO2e) as the difference between the ex-ante estimation of baseline emissions (ERy) and ex-ante estimations of leakage emissions (LEy) as follows:

Emission Reductions = ER_y - LE_y

Ex-ante estimation of baseline emissions (ER_y):
By applying applicable approach of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1)[47] for estimating the amount of methane generated in the landfill during each year of the 1st 7-year crediting period , ex-ante estimations of baseline emissions (BEy) are determined (in tCO2e) as follows:

$ER_y = ER\_CH4_y * GWP\_CH4$

Where:

GWP_CH4 Global Warming Potential (GWP) of methane. GWP_CH4 is ex-ante determined as 21 tCO_2e/ tCH_4 (default value)

ER_CH4_y Methane emission reduction (in tCH_4). In the context of the ex-ante estimation of emission reductions to be achieved by the project activity, ER_CH4_y is estimated (in tCH_4)[48] as follows:

$$ER\_CH4_y = CH4_{flared,y} - CH4_{baseline,y}$$

Where:

$$CH4_{baseline,y} = CH4_{contract,y}$$

and

$$CH4_{flared,y} = \eta_{PJ} * BE_{CH4,SWDS,y}/GWP\_CH4$$

[47] As one of the post-registration changes (under the category "Corrections (that do not affect the project design)" which was addressed by the previously revised version of the PDD, the ex-ante estimations of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period were revised. This revision was due to the following aspects:

- Application of more accurate values for organic content and amount of Municipal Solid Waste (MSW) historically disposed at the AMC landfill;
- Use of more appropriate approach for estimating the amount of methane to be generated at the AMC landfill and to be collected by the project activity. Such estimations are performed by applying a more recent and appropriated approach as per the methodological tool "Emission from solid waste disposal sites" (version 6.0.1).
- Consideration of leakage emissions due to the consumption of both grid-sourced electricity and LPG by the project activity
- Consideration of the correct value for the ex-ante determined parameter CF (density of methane).

By taking into account the relative limitations of the methodological approach of AM0002 (version 1), the ex-ante estimate of methane generation at the AMC landfill is performed by applying applicable approach of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1). Such alternative approach promotes more accurate and correct estimates of emission reductions (without affecting the amount of baseline emissions to be determined ex-post as part of the application of the project's monitoring plan + applicable GHG calculations.

[48] As outlined in the emission reduction calculation spreadsheet which is enclosed to the PDD, in the particular context of ex-ante estimation of emission reduction to be achieved by the project activity, ER_CH4_y and $CH4_{flared,y}$ are calculated in mass basis (tCH_4) in order to facilitated related calculations. $BE_{CH4,SWDS,y}$ is also estimated in mass basis (tCO_2e) as established by the methodological approach as per the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1).

Where:

$CH4_{contract,y}$ Amount of methane destruction in the absence of the project activity as per contractual agreement (in tCH_4).

$CH4_{flared,y}$ Quantity of methane actually flared (in tCH_4).

η_{PJ} Estimated efficiency of the LFG capture system that will be installed in the project activity. η_{PJ} is estimated as 92.80%.

GWP_CH4 Global Warming Potential (GWP) of methane. GWP_CH4 is ex-ante determined as 21 tCO_2e/ tCH_4 (default value).

$BE_{CH4,SWDS,y}$ Amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year *y* (in tCO_2e). $BE_{CH4,SWDS,y}$ is determined by applying applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) by *inter alia* considering the following:

- f_y in the methodological tool is assigned a value of 0 because the amount of LFG that would have been captured and destroyed is already accounted.
- In the methodological tool, *x* begins with the year that MSW started to be disposed in the AMC landfill.
- Sampling to determine the fractions of different waste types is not necessary as waste composition can be obtained from previous studies and no MSW disposal is prevented as a result of the operation of the project.

By following applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1), $BE_{CH4,SWDS,y}$ is determined as follows:

$$BE_{CH4,SWDS,y} = \varphi_y * (1 - f_y) * GWP\_CH4 * (1 - OX) * \frac{16}{12} * F * DOC_{f,y} * MCF_y * \sum_{x=1}^{y} \sum_{j} W_{j,x} * DOC_j * e^{-k_j \cdot (y-x)} * (1 - e^{-k_j})$$

Where:

x Years in the time period in which waste is disposed at the AMC landfill, extending from the first year in the time period (*x* = 1) to year *y* (*x* = *y*)

y Year of the crediting period for which methane emissions are calculated (*y* is a consecutive period of 12 months)

$DOC_{f,default}$ Fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year *y* (weight fraction) (default value)

$W_{j,x}$ Amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (t). For every year x, it is assumed for $W_{j,x} = 0$.

φ_y Model correction factor to account for model uncertainties

f_y Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year *y*

GWP_CH4 Global Warming Potential of methane

OX Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste).

F Fraction of methane in the SWDS gas (volume fraction)

$MCF_{default}$ Methane correction factor for year *y* (default value)

DOC_j Fraction of degradable organic carbon in the waste type *j* (weight fraction)

k_j Decay rate for the waste type *j* (1 / yr)

j Type of residual waste or types of waste in the MSW

By considering the ex-ante selected values for the parameters above-presented as described in Section B.6.2 and the assumed values for parameters to be monitored ex-post (as presented in Section B.7.1), ex-ante estimates of emission reductions are performed in a calculation spreadsheet which is enclosed to this PDD. By applying applicable calculations, the ex-ante estimation of the baseline emissions is as follows[49]:

	Estimation of $BE_{CH4,SWDS,y}$ (tCO_2e)	*Estimation of $CH4_{flared,y}$ (tCH_4)*	*$CH4_{baseline,y}$ (tCH_4)*	*Estimation of baseline emissions (tCO_2e)*
Year	$BE_{CH4,SWDS,y} = \varphi\ (1-f) * GWP\_CH4 * (1-OX) * 16/12 * F * DOC_f * MCF * \Sigma\Sigma\ w_{j,x} * DOC_j * e^{-kj(y-x)} * (1-e^{-kj})$	$CH4flared,y = n_{PJ} * BE_{CH4,SWDS,y}/GWP\_CH4$	$CH4_{baseline,y} = CH4_{contract,y} * CF$	$ER_y = ER\_CH4_y * GWP\_CH4 = (CH4_{flared,y} - CH4_{baseline,y}) * GWP\_CH4$
2004	391,959	17,321	1,164	339,295
2005	418,909	18,512	1,413	359,069
2006	443,810	19,612	1,684	376,490
2007	469,294	20,738	1,355	407,055
2008	493,543	21,810	1,480	426,937
2009	518,201	22,900	1,284	453,932
2010	545,935	24,125	1,099	483,552
Total	**3,281,651**	**145,018**	**9,478**	**2,846,331**

Ex-ante estimations of leakage emissions (LE_y):

Leakage emissions in year *y* (LE_y) are calculated (in tCO_2/yr) as follows:

$$LE_y = LE_{EC,grid,y} + LE_{FC,LPG,y}$$

Where:

$LE_{EC,grid,,y}$ Leakage emissions due to the consumption of grid-sourced electricity by the project activity in year *y* (in tCO_2/yr)

$LE_{FC,LPG,,y}$ Leakage emissions due to the consumption of fossil fuels LPG by the project activity (for purpose other than electricity generation) in year *y* (in tCO_2/yr)

Details about the determination of $LE_{EC,grid,y}$ and $LE_{FC,LPG,,y}$ are presented below:

Leakage emissions due to the consumption of electricity by the project activity ($LE_{EC,grid,y}$)

Leakage emissions due to the consumption of grid-sourced electricity by the project activity *($LE_{EC,grid,,y}$)* are calculated by following the applicable guidance of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" with the following observations:

[49] All related calculations in the context of the ex-ante estimations of emissions reductions are presented in an emission reduction calculation spreadsheet enclosed to this PDD.

Leakage emissions from electricity consumption in year *y* ($LE_{EC,y}$) are calculated (in tCO_2/yr) as follows:

$$LE_{EC,grid,y} = EC_{grid,y} * EF_{EL,grid,y} * (1 + TDL_{grid,y})$$

Where:

$EC_{grid,y}$	Quantity of grid-sourced electricity consumed by the project activity in year *y* (in MWh).
$TDL_{grid,y}$	Average technical transmission and distribution losses in the National Grid of Brazil in year *y*.
$EF_{EL,grid,y}$	Emission factor for grid-sourced electricity generation in year *y* (in tCO_2/MWh). The project activity will consume electricity sourced by the National Electricity Grid of Brazil. This grid is locally denominated *Sistema Interconectado Nacional (SIN)* (Brazilian Interconnected System). The DNA of Brazil has published the delineation of SIN grid to be adopted for the purposes of CDM projects. As per Resolution Nº8 of the DNA of Brazil, the connected electricity system to be considered in this project activity is considered as a single system consisted by the sub-markets of SIN as the definition of the electric system of the project. As established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", $EF_{EL,grid,y}$ is calculated ex-post as the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) for the SIN grid by following the applicable guidance of the latest version of the "Tool to calculate the emission factor for an electricity system". The following equations are applicable for the determination of $EF_{grid,CM,y}$:

$$EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Where:

$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

Annual official values for $EF_{grid,OM,}$ and $EF_{grid,BM,y}$ are regularly calculated and published by the DNA of Brazil (Brazilian Inter-ministerial Commission for Global Climate Change). As per information made publicly available by the DNA of Brazil for years 2006 to 2013, such official values for $EF_{grid,OM,}$ and $EF_{grid,BM,y}$ are calculated in full accordance with the most recent version of the "Tool to calculate the emission factor for an electricity system".

It is assumed in the context of the ex-ante estimation:

- The values for w_{OM}, w_{BM} and $TDL_{grid,y}$ as ex-ante selected and indicated in Section B.6.2;
- $EC_{grid,y}$ as being 1,892 MWh per year along the whole 7-year renewable crediting period;

- Values for $EF_{grid,OM,y}$ for the years encompassed by the 1st 7-year crediting period are the official values as published by the DNA of Brazil (with exception of values for years 2006 and 2010) as follows:

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Year	Value for $EF_{grid,OM,y}$
2006	0.3232
2007	0.2909
2008	0.4766
2009	0.2476
2010	0.4787
Note: As the DNA of Brazil has not published values of $EF_{grid,OM,y}$ for years 2004 and 2005, the official value of $EF_{grid,OM,y}$ for year 2006 is thus assumed for these years.	

- Values for $EF_{grid,BM,y}$ for the years encompassed by the 1st 7-year crediting period are the official values as published by the DNA of Brazil (with exception of values for years 2006 and 2010) as follows:

Year	Value for $EF_{grid,BM,y}$
2006	0.0814
2007	0.0775
2008	0.0814
2009	0.0794
2010	0.1404
Note: As the DNA of Brazil has not published values of $EF_{grid,BM,y}$ for years 2004 and 2005, the official value of $EF_{grid,BM,y}$ for year 2006 is thus assumed for these years.	

Thus, the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) for the years encompassed by the 1st 7-year crediting period are determined as follows:

$$EF_{EL,grid,y} = EF_{grid,CM,y} = w_{OM} * EF_{grid,OM,y} + w_{BM} * EF_{grid,BM,y}$$

Values for $EF_{grid,CM,y}$ for the years encompassed by the 1st 7-year crediting period are the determined as follows:

Year	Value for $EF_{grid,CM,y}$
2006	0.2023
2007	0.1842
2008	0.2790
2009	0.1635
2010	0.3095
Note: As the DNA of Brazil has not published values of $EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ for years 2004 and 2005, the calculated value of $EF_{grid,CM,y}$ for year 2006 is thus assumed for these years.	

The ex-ante estimation of the leakage emissions is thus as follows:

LE_y	Quantity of grid-sourced electricity consumed by the project activity in year *y* (MWh)	LPG consumed by the project activity (ton)	Leakage emissions due to grid electricity consumption by the project activity (tCO_2)	Total Leakage emissions promoted the project activity - LE_y (tCO_2e)
Year	$EC_{grid,y}$	$FC_{LPG,y}$	$LE_{EC,grid,y} = EC_{grid,y} * EF_{EL,\ grid} * (1+TDL_{grid,y})$	$LE_y = LE_{EC,grid,y} + LE_{FC,LPG,y}$
2004	1,892	0.85	459	462
2005	1,892	0.85	459	462
2006	1,892	0.85	459	462
2007	1,892	0.85	418	421
2008	1,892	0.85	633	636
2009	1,892	0.85	371	374
2010	1,892	0.85	703	706
Total	**13,245**	**5.95**	**3,504**	**3,523**

Therefore the ex-ante estimation of the emission reductions achieved by the project activity during the 1st 7-year crediting period is as follows:

ER_y	Emission reductions (tCO_2e)
Year	$ER_y = ER_y - LE_y$
2004	338,833
2005	358,607
2006	376,028
2007	406,634
2008	426,301
2009	453,558
2010	482,846
Total	**2,842,808**

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B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2004	339,295	0	462	338,833
2005	359,069	0	462	358,607
2006	376,490	0	462	376,028
2007	407,055	0	421	406,634
2008	426,937	0	636	426,301
2009	453,932	0	374	453,558
2010	483,552	0	706	482,846
Total	**2,846,331**	**0**	**3,523**	**2,842,808**

Total number of crediting years	7			
Annual average over the crediting period	**406,619**	**0**	**503**	**406,115**

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Monitoring parameters required for determining baseline emissions:

Data / Parameter	**$WASTE_{actual}$**
Unit	ton
Description	Annual Waste Landfilled.
Source of data	Measured at weigh bridge.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction to be achieved by the project activity during the 1st 7-year crediting period. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared as part of the operation of project activity in year y as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill. The amount of methane that is required to be destroyed in the baseline scenario (absence of the project activity) is also considered for estimating annual values of baseline emissions due to methane emissions.
Measurement methods and procedures	$WASTE_{actual}$ represents the quantity of waste actually disposed at the landfill during the year encompassed by the considered monitoring period. Waste disposed at the landfill is weighted at the entrance of the landfill as part of its normal operation.
Monitoring frequency	Records of daily measurements are consolidated into monthly and annual basis.
QA/QC procedures	-
Purpose of data	As per AM0002 (version 1), $WASTE_{actual}$ is applied for the determination of the quantity of methane flared at the baseline scenario ($CH4_{baseline,y}$) as a function of the quantity of methane flared at the baseline scenario as established under the contractual agreement ($CH4_{contract,y}$). It is however crucial to note that in the context of the applied more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario [50], records of $WASTE_{actual}$ are not taken into account. Anyway, for sake of completeness, this monitoring parameter is kept in the monitoring plan of the project activity for the 1st 7-year crediting period and it is thus required to be monitored accordingly.

[50] The use of a more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario (absence of the project activity) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices) was addressed in the previously revised

Additional comment	-

Data / Parameter	**$CH4/LFG_{actual}$**
Unit	%
Description	Annual calculated weighted average methane content in landfill gas during the year encompassed by the considered monitoring period.
Source of data	Measurements performed on-site.
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction to be achieved by the project activity during the 1st 7-year crediting period. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared as part of the operation of project activity in year y as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics of the landfill. The amount of methane that is required to be destroyed in the baseline scenario (absence of the project activity) is also considered for estimating annual values of baseline emissions due to methane emissions.
Measurement methods and procedures	Average value for the year encompassed by the considered monitoring period is determined as the average of all every 20-second performed measurement records of fraction of methane in collected LFG. The value is automatically calculated by the project's electronic monitoring infrastructure.
Monitoring frequency	Records of daily measurements are consolidated into monthly and annual basis.
QA/QC procedures	-
Purpose of data	As per AM0002 (version 1), $CH4/LFG_{actual}$ is applied for the determination of the quantity of methane flared at the baseline scenario ($CH4_{baseline,y}$) as a function of the quantity of methane flared at the baseline scenario as established under the contractual agreement ($CH4_{contract,y}$). It is however crucial to note that in the context of the applied more appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario, records of $CH4/LFG_{actual}$ are not taken into account. Anyway, for sake of completeness, this monitoring parameter is kept in the monitoring plan of the project activity for the 1st 7-year crediting period and it is thus required to be monitored accordingly.
Additional comment	-

version of the PDD (version 6, dated 27/12/2013) as a post-registration change (under the category "permanent change in the monitoring plan from the registered PDD"). This needed change is based on applicable contractual requirements and data/information made available by the Administration of the Municipality of Salvador (municipal authority). By applying such revised monitoring approach, it is assumed that the quantitative value for the parameter $CH4_{baseline,y}$ is equal to the value for the monitoring parameter $CH4_{contract,y}$ for each year of the crediting period.

<table>
<tr><td>Data / Parameter</td><td>$CH4_{flared,y}$</td></tr>
<tr><td>Unit</td><td>tCH_4 (and Nm^3)[51]</td></tr>
<tr><td>Description</td><td>Amount of methane flared.</td></tr>
<tr><td>Source of data</td><td>In accordance both with AM0002 (version 1) and project design, $CH4_{flared,y}$ is determined as part of the operation of the project activity on the basis of (i) continuous measurements of flow of collected LFG which is sent to the high temperature enclosed flares and (ii) continuous measurements of fraction of methane in the collected LFG. The ex-ante determined value for density of methane (parameter CF) is also considered for reporting the values in tCH4 (as required for performance of baseline emission calculations which are outlined in Section B.6.1).</td></tr>
<tr><td>Value(s) applied</td><td>The following annual values are applied:

<table>
<tr><th>Year</th><th>Value for $CH4_{flared,y}$ (tCH_4)</th></tr>
<tr><td>2004</td><td>17,321</td></tr>
<tr><td>2005</td><td>18,512</td></tr>
<tr><td>2006</td><td>19,612</td></tr>
<tr><td>2007</td><td>20,738</td></tr>
<tr><td>2008</td><td>21,810</td></tr>
<tr><td>2009</td><td>22,900</td></tr>
<tr><td>2010</td><td>24,125</td></tr>
</table>
</td></tr>
<tr><td>Measurement methods and procedures</td><td>Continuous measurements of (i) flow of collected LFG which is sent to the installed high temperature enclosed flares and continuous measurements of (ii) fraction of methane in the collected LFG are performed with appropriate measurement equipment (LFG flow meter, LFG temperature sensor, LFG pressure sensor and continuous CH_4 content gas analyser unit). Measurement records are used for the determination of hourly values of $CH4_{flared,y}$.</td></tr>
<tr><td>Monitoring frequency</td><td>As per AM0002 (version 1), daily monitoring frequency is required. In the particular case of the project activity, every hour values of $CH4_{flared,y}$ are determined. Each every hour value for $CH4_{flare,y}$ is determined and reported on the basis of the following data:
- every 20 seconds measurement records of flow of collected LFG which is sent to the high temperature enclosed flares
- every 20 seconds measurement records of LFG temperature
- every 20 seconds measurement records of LFG pressure
- every 20 seconds measurement records of fraction of methane in the collected LFG</td></tr>
<tr><td>QA/QC procedures</td><td>Records of flare working hours are applied as a cross-checking.</td></tr>
<tr><td>Purpose of data</td><td>Data is applied for the determination of baseline emissions.</td></tr>
<tr><td>Additional comment</td><td>By taking into consideration ex-ante defined values for the parameters CF (density of methane), the calculated values of $CH4_{flared,y}$ are also reported in tCH_4.</td></tr>
</table>

[51] While as per AM0002 (version 1), the accumulated value of the monitoring parameter $CH4_{flared,y}$ is to be reported in tCH_4, the calculation procedure for baseline emissions in both registered PDD and AM0002 (version 1) requires the accumulated value of the monitoring parameter $CH4_{flared,y}$ to be accounted in Nm^3 of CH_4. Due to that, values are to be reported in both units (by considering the ex-ante determined value of CH4 density (parameter CF).

Data / Parameter	$CH4_{contract,y}$
Unit	Nm^3 (and tCH_4)[52]
Description	Contractual amount of methane flaring required in baseline.
Source of data	Annual values of $CH4_{contract,y}$ are defined by the Administration of the Municipality of Salvador (municipal authority).
Value(s) applied	The following annual values are applied: Year / Value for $CH4_{contract,y}$ (Nm^3) 2004 / 1,623,789 2005 / 1,971,601 2006 / 2,349,427 2007 / 1,890,050 2008 / 2,064,097 2009 / 1,790,928 2010 / 1,533,000
Measurement methods and procedures	As per the applied monitoring procedure, annual values for $CH4_{contract,y}$ are defined by the Administration of the Municipality of Salvador (municipal authority).
Monitoring frequency	Annually.
QA/QC procedures	-
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	Contractual amount of methane flaring required in baseline adjusted by amount of waste received and actual methane content of the landfill gas ($CH4_{baseline,y}$) is demonstrated to be equal to $CH4_{contract,y}$.

Data / Parameter	FE
Unit	%
Description	Flare efficiency
Source of data	
Value(s) applied	No estimated value is required for the determination of ex-ante estimation of emission reduction to be achieved by the project activity during the 1st 7-year crediting period. Baseline emissions are ex-ante estimated by estimating the amount of methane in the LFG which is flared as part of the operation of project activity in year y as a function of ex-ante estimated values for efficiency of the LFG capture system that will be installed in the project activity (η_{PJ}) as well as ex-ante estimations for the amount of methane in the LFG that is generated from the SWDS in the baseline scenario in year y ($BE_{CH4,SWDS,y}$) by using applicable guidance of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1) and considering aspects/characteristics

[52] While as per AM0002 (version 1), the value of the monitoring parameter $CH4_{contract,y}$ is to be reported in tCH_4, the calculation procedure for baseline emissions in both registered PDD and AM0002 (version 1) requires the value of the monitoring parameter $CH4_{contract,y}$ and calculation parameter $CH4_{baseline,y}$ to be both accounted in Nm^3 of CH_4. Due to that the monitored values for $CH4_{contract,y}$ and the calculated value for $CH4_{baseline,y}$ are to be presented in both units (by considering the ex-ante determined value of CH_4 density (parameter CF).

	of the landfill. The amount of methane that is required to be destroyed in the baseline scenario (absence of the project activity) is also considered for estimating annual values of baseline emissions due to methane emissions.
Measurement methods and procedures	FE values are to be regularly determined on the basis of quarterly measurements of the amount of residual methane content in the exhaust gas of the flares, which are performed by a third-party independent inspection service company. As part of each FE determination event, the efficiency of the flares (FE) was determined on basis of the following: - measurements of residual concentration of methane in collected samples of the exhaust gas of the flares. - out flow of exhaust gas in the flare being evaluated - inflow of methane in the flare being evaluated
Monitoring frequency	In accordance with AM0002 (version 1), measurements and calculations for the determination of FE values are to be performed 4 times per year.
QA/QC procedures	
Purpose of data	Data is used for the determination of baseline emissions.
Additional comment	

Monitoring parameters required for the determination of leakage emissions (due to the consumption of grid-sourced electricity and LPG by the project activity):

Data / Parameter	**$EC_{grid,y}$**
Unit	MWh
Description	Amount of grid electricity consumed by the project activity during the year *y*
Source of data	Measured as part of the operation of the project activity by applying appropriate electricity meter(s).
Value(s) applied	It is estimated that the project activity will consume 1,892 MWh of grid-sourced electricity per year during the 1st 7-year crediting period.
Measurement methods and procedures	Appropriated electricity meters. Measurement records will be cross-checked against available electricity consumption receipts/invoices issued by the local electricity distribution company.
Monitoring frequency	Continuous measurements will be aggregated automatically. Accumulated measurement records will be reported at least once a week.

QA/QC procedures	Periodic calibration events will be performed in a frequency as per instrument specifications and/or instrument manufacturer's recommendations. Instrument will be subject to a regular maintenance and testing regime in accordance to appropriate national / international standards/requirements and/or best practice.
Purpose of data	Calculation of leakage emissions.
Additional comment	The values considered in the context of the ex-ante estimation of emission reductions were selected based on the nameplate power output for the installed centrifugal blowers (as per the project configuration in December 2010). The installed centrifugal blowers are the most electricity intensive equipment of the project activity). Additional 10 kW in the estimated value for electricity consumption is considered in order to address the potential electricity consumption of other less electricity intensive equipment. Also as an assumption, it is considered that the project activity operates 24 hours a day during the entire 1st 7-year renewable crediting period.

Data / Parameter	**$EF_{grid,OM,y} = EF_{grid,OM-DD,y}$**
Unit	tCO_2/MWh
Description	Operation margin CO_2 emission factor in year *y* = Dispatch data analysis operating margin CO_2 emission factor in year *y*.
Source of data	Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the "Tool to calculate the emission factor for an electricity system".
Value(s) applied	The following annual values are considered for the determination of ex-ante estimations of emission reductions:

Year	Value for $EF_{grid,OM,y}$
2004	0.3232[53]
2005	
2006	
2007	0.2909
2008	0.4766
2009	0.2476
2010	0.4787

Measurement methods and procedures	Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Data will be determined as per applicable guidance for dispatch data analysis operating margin CO_2 emission factor of the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures	-
Purpose of data	Determination of leakage emissions (due to the consumption of grid-sourced electricity by the project activity).

[53] Note: As the DNA of Brazil has not published values of $EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ for years 2004 and 2005, the calculated value of $EF_{grid,CM,y}$ for year 2006 is thus assumed for these years in the particular context of ex-ante estimates of emission reductions to be achieved by the project activity. Further details are included in Section B.6.3.

Additional comment	$EF_{grid,OM,y}$ = $EF_{grid,OM\text{-}DD,y}$ will be monitored only if $EF_{EL,grid,y}$ is determined based on the determination of Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) as per the "Tool to calculate the emission factor for an electricity system".

Data / Parameter	**$EF_{EL,grid,y}$**
Unit	tCO_2/MWh
Description	Emission factor for grid electricity generation in year *y.*
Source of data	As established by the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", $EF_{EL,grid,y}$ will be calculated ex-post as the Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) for the SIN grid by following the applicable guidance of the latest version of the "Tool to calculate the emission factor for an electricity system". $EF_{grid,CM,y}$ is to be determined as the average between $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$. As an alternative, an applicable default value as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" will be applied.
Value(s) applied	The following annual values are considered for the determination of ex-ante estimations of emission reductions:

Year	Value for $EF_{grid,CM,y}$
2004	0.2023[54]
2005	
2006	
2007	0.1842
2008	0.2790
2009	0.1635
2010	0.3095

Measurement methods and procedures	$EF_{EL,grid,y}$ will be determined by following one of the following options: - Application of conservative default value as per the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" - Determination of Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) as per the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Every year.
QA/QC procedures	-
Purpose of data	Determination of leakage emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comment	-

Data / Parameter	**$EF_{grid,BM,y}$**

[54] Note: As the DNA of Brazil has not published values of $EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ for years 2004 and 2005, the calculated value of $EF_{grid,CM,y}$ for year 2006 is thus assumed for these years in the particular context of ex-ante estimates of emission reductions to be achieved by the project activity. Further details are included in Section B.6.3.

Unit	tCO_2/MWh
Description	Build margin CO_2 emission factor in year *y*.
Source of data	Data will be determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system".
Value(s) applied	The following annual values are considered for the determination of ex-ante estimations of emission reductions:

Year	Value for $EF_{grid,BM,y}$
2004	0.0814[55]
2005	
2006	
2007	0.0775
2008	0.0814
2009	0.0794
2010	0.1404

Measurement methods and procedures	Data will be determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system".
Monitoring frequency	Data will be determined as per applicable guidance of the "Tool to calculate the emission factor for an electricity system".
QA/QC procedures	-
Purpose of data	Determination of leakage emissions (due to the consumption of grid-sourced electricity by the project activity).
Additional comment	$EF_{grid,BM,y}$ will be monitored only if $EF_{EL,grid,y}$ is determined based on the determination of Combined margin CO_2 emission factor ($EF_{grid,CM,y}$) as per the "Tool to calculate the emission factor for an electricity system".

Data / Parameter	**$FC_{LPG,y}$**
Unit	ton of LPG
Description	Quantity of LPG consumed by the project activity.
Source of data	Measurements using mass meters (scale) or an alternative appropriate measurement instrument.
Value(s) applied	0.85
Measurement methods and procedures	Measurements using mass meters (scale) or an alternative appropriate measurement instrument.
Monitoring frequency	Measurements of quantity of LPG by the project activity will be monitored with frequency not lower than once a month.
QA/QC procedures	-
Purpose of data	Determination of leakage emissions (due to the consumption of fossil fuel LPG by the project activity).
Additional comment	-

Data / Parameter	**$NCV_{LPG,y}$**
Unit	GJ/ton

[55] Note: As the DNA of Brazil has not published values of $EF_{grid,BM,y}$ and $EF_{grid,OM,y}$ for years 2004 and 2005, the calculated value of $EF_{grid,CM,y}$ for year 2006 is thus assumed for these years in the particular context of ex-ante estimates of emission reductions to be achieved by the project activity. Further details are included in Section B.6.3.

Description	Net calorific value for fossil fuel LPG.
Source of data	Value provided by the fuel supplier in invoices, regional or national default values or IPCC default values (at upper limit of uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories[56]).
Value(s) applied	0.0000465
Measurement methods and procedures	-
Monitoring frequency	In case values are provided by the fuel supplier in invoices, the applied weighted average annual value will be determined based on provided related information in the context of each individual fuel delivery event. In case regional or national default values or IPCC default values are considered an every year monitoring frequency is applied.
QA/QC procedures	Both values provided by the fuel supplier in invoices as well as regional or national default values will be confirmed to be within the uncertainty range of the IPCC default values (as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines). If the considered values fall below this range, additional information and/or justification will be collected and will be used to justify the outcome. The laboratory(ies) sourcing related measurements or analysis will be confirmed to have ISO17025 accreditation (or it will be justified that it/they can comply with similar quality standards).
Purpose of data	Determination of leakage emissions (due to the consumption of fossil fuel LPG by the project activity).
Additional comment	If the LPG supplier does provide related NCV values and CO_2 emission factor for the delivered fuel on the invoice and these two values are based on measurements for this specific fuel, this source will be used for the determination of values for the monitoring parameter $NCV_{LPG,y.}$. In case another source(s) for the values is/are applied, regional or national default values or IPCC default values will thus be considered.

Data / Parameter	**$EF_{CO2,LPG,y}$**
Unit	tCO_2/GJ LPG
Description	CO_2 emission factor for fossil fuel LPG.
Source of data	Value provided by the fuel supplier in invoices, regional or national default values or IPCC default values (at upper limit of uncertainty at 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories)[57]. Appropriate net calorific value (NCV) for LPG may be used for converting energy basis data into mass basis data.
Value(s) applied	65,600
Measurement methods and procedures	-

[56] Any future revision of the IPCC Guidelines will be taken into account.

[57] Any future revision of the IPCC Guidelines will be taken into account.

Monitoring frequency	In case values are provided by the fuel supplier in invoices, the applied weighted average annual value will be determined based on provided related information in the context of each individual fuel delivery event. In case regional or national default values or IPCC default values are considered an every year monitoring frequency is applied.
QA/QC procedures	Both values provided by the fuel supplier in invoices as well as regional or national default values will be confirmed to be within the uncertainty range of the IPCC default values (as per 2006 IPCC Guidelines on National GHG Inventories - applicable value at upper limit of uncertainty at 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy).). If the considered values fall below this range, additional information and/or justification will be collected and will be used to justify the outcome.
Purpose of data	Data will be used for the determination of leakage emissions (due to the consumption of fossil fuel LPG by the project activity).
Additional comment	-

B.7.2. Sampling plan

>>
Not applicable.

B.7.3. Other elements of monitoring plan

>>
This section includes descriptions of details of applicable monitoring procedures which are in place since the start of operations of the project activity.

Monitoring data required for the determination of the parameter “Amount of flared methane” (e.g. flow of collected LFG sent to the flares, LFG pressure, LFG temperature, methane content of collected LFG, temperature of the exhaust gases of the flares) are continuously measured by related instruments/equipment. The images below show the installation of some of the monitoring instruments/equipment (as per the implemented project configuration during the period from March 2004 to the end of year 2010):

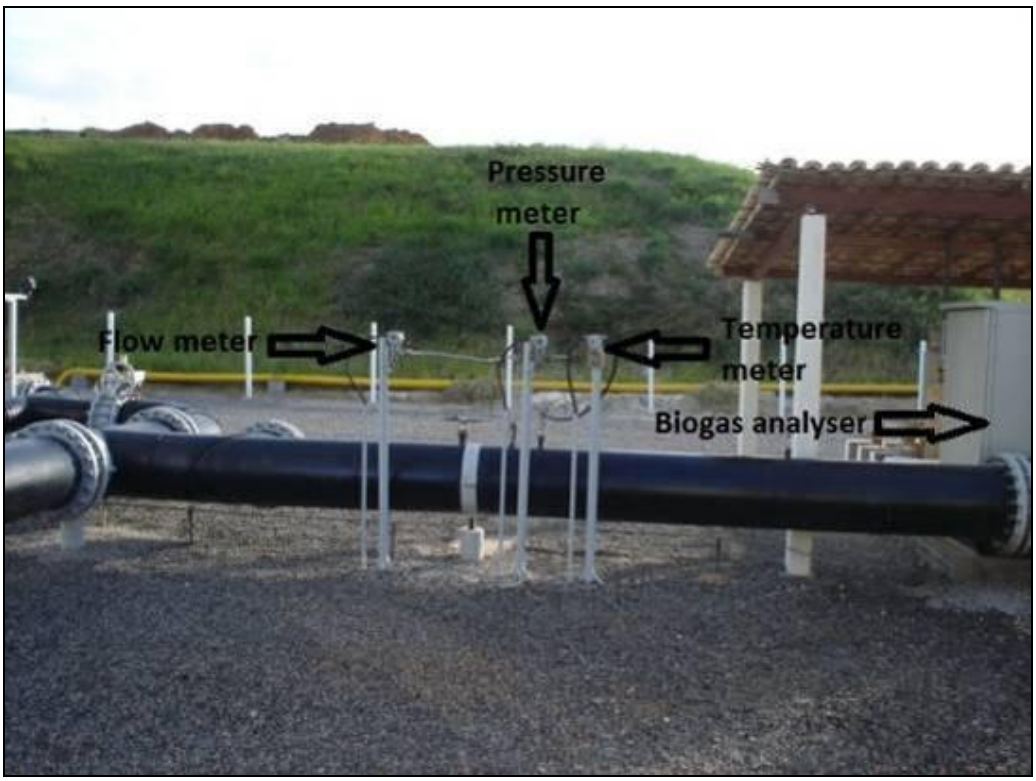

Figure 8: Location of the LFG flow meter, LFG pressure sensor, LFG pressure sensor and the CH_4/O_2 content gas analyzer unit (picture dated April 2005)

Figure 9: Location of the LFG pressure sensor, LFG pressure sensor (picture dated April 2005)

Figure 10 – Location of the thermocouple used to measure temperature of the exhaust gas of the flare (1 thermocouple for each flare)

Figure 11 – View of the panel of the installed CH_4/O_2 content gas analyzer unit

The amount of working hours for the flares is determined by an installed programmable logic controller unit (PLC unit) which calculates total flare working hours for the operating flares as the sum of the time each one of the flare has operated with temperature of the exhaust gases higher than 500ºC (for each flare in operation)[58].

[58] As part of the application of the monitoring plan for the project activity, the sum of flares working hours (for each individual flare) is measured as the amount of hours of which each one of the 3 flares have operated with temperature of exhaust gas higher than 500ºC (for all flares). Thus, in the context of the application of the monitoring plan, differently than the typical case of other LFG collection and destruction CDM project activities adopting more recent versions of the

Figure 12 – Project's Control screen with real-time information of the operation of the LFG destruction station

Since year 2004, continuous measurements of flow of collected LFG sent to the flares, LFG temperature, LFG pressure, CH_4 content of collected LFG have been processed by a programmable logic controller (PLC) unit and recorded with an every 20-second frequency in a local customized MS-Access™ database (installed in a local computer located in the project site).

The amount of methane flared (monitoring parameter $CH_{4,flared,y}$) is directly calculated by the installed and set PLC unit with an every-hour frequency. Recorded hourly values for $CH_{4,flared,y}$ have been regularly and automatically recorded/reported (every hour) in a main/master data reporting & recording MS-Excel™ spreadsheet file titled "*Salvador da Bahia LFG Management_MVP Workbook_V03 October 2.xls*". This file is automatically fed with data from the PLC unit. The total time of which all flares have operated with exhaust gas temperature above 500°C during each individual day of the considered monitoring period is also directly calculated by the PLC unit and accumulated incremental daily values is regularly recorded/reported (every hour) in the same MS-Excel™ spreadsheet.

The main/master data recording & reporting spreadsheet file is titled "*Salvador da Bahia LFG Management_MVP Workbook_V03 October 2.xls*" and it has been developed by certified IT experts and appropriately synchronized with the installed PLC unit during the project construction and commissioning phase. As per the design of the project's monitoring system, this file has been

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ACM0001 / AMS-III.G methodologies (which refers to the "Tool to determine project emissions from flaring gases containing methane"), continuously measurements of temperature of the exhaust gases of the flares are thus not used to determined flare efficiency (FE). In the context of the monitoring for the "Salvador da Bahia Landfill Gas Management" project, such measurements of temperature of the exhaust gas of each flare are only used to determine the monitoring parameter "flare operating hours". In the context of the application of the monitoring plan for the project activity, monitoring of "flare operating hours" is to be seen as a mere QA/QC procedure for the determination of the amount of methane which is combusted in the flares. By comparing the reported total amount of flare working hour for the flares during one day of the monitoring period with the total amount of flare methane for the same day, one can roughly confirm the plausibility of reported values of daily amount of destroyed methane.

updated every hour. In the end of the 1st 7-year renewable crediting period, it included about 7 years of historical monitoring records (since the first operational day of the project activity in year 2004 until 31 December 2010).

The project's MS-Access™ database works as a monitoring data back-up and it also works as proof of authenticy of data which is recorded/reported in the main/master data recording & reporting MS-Excel™ spreadsheet in an every-hour basis. Data recorded in the existent MS-Access™ database is thus not used for formal reporting purposes. Anyway, such data is used as a reliable data cross-checking. As per the design of the project's monitoring system, all information recorded and stored in the customized MS-Access™ based database is also regularly archived in back-up CD units (which are achieved in the a safe manner in the project site).

Consumption of grid-sourced electricity consumption by the project activity is measured with appropriated electricity meter.

Figure 13 – View of installed electricity meter

Values for the monitoring parameter flare efficiency (FE) is determined on periodically performed flare efficiency tests (as per conducted sample measurements/tests on the basis of four sample analysis/tests of residual methane in the exhaust gases of the flares).

The schematic diagram presents below summarizes the flow of monitoring data, information processing and data storage/archiving applicable for the monitoring of the project activity.

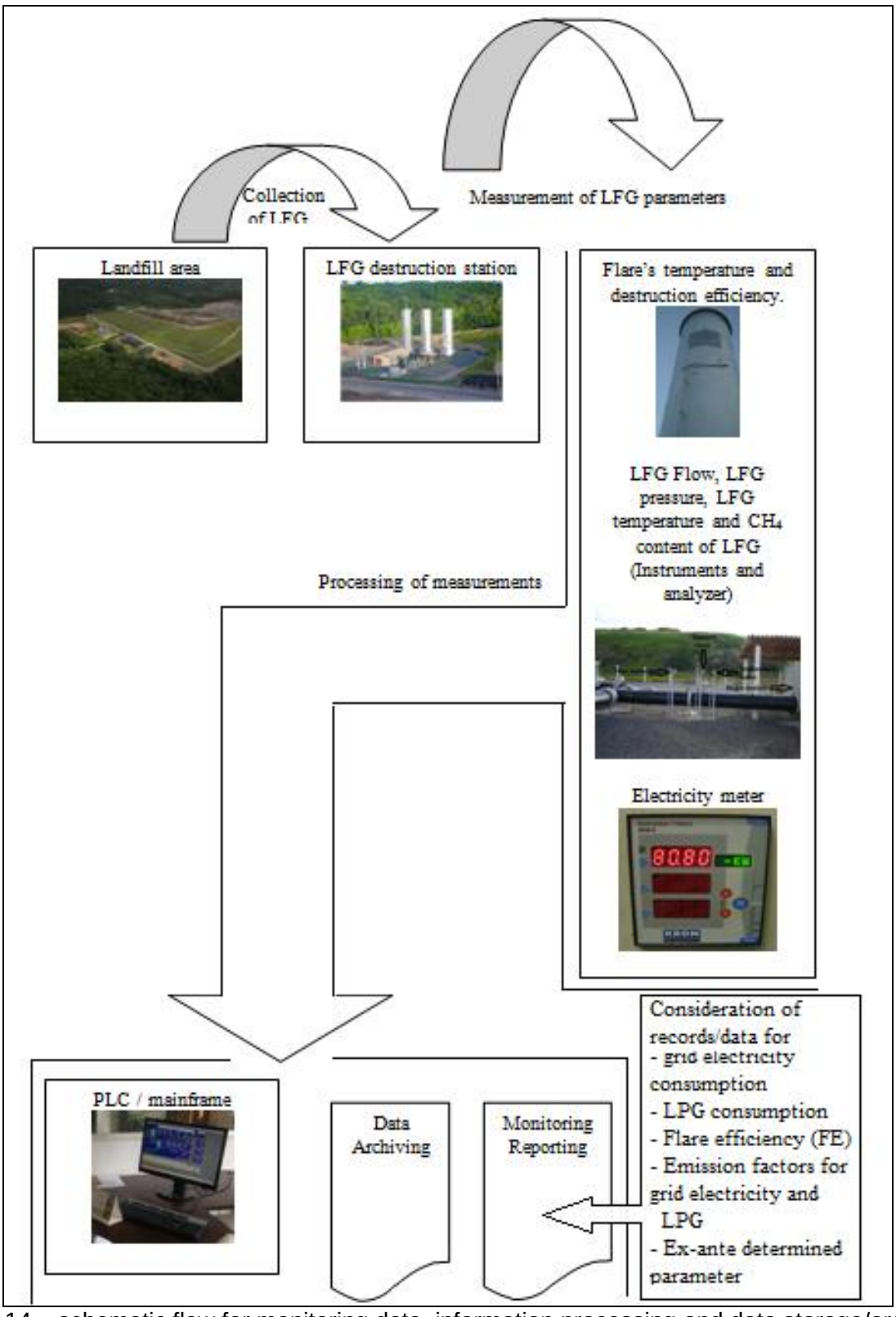

Figure 14 – schematic flow for monitoring data, information processing and data storage/archiving applicable for the monitoring of the project activity

Responsibilities and Roles:

The schematic diagram presented below includes the organizational structure for the project activity:

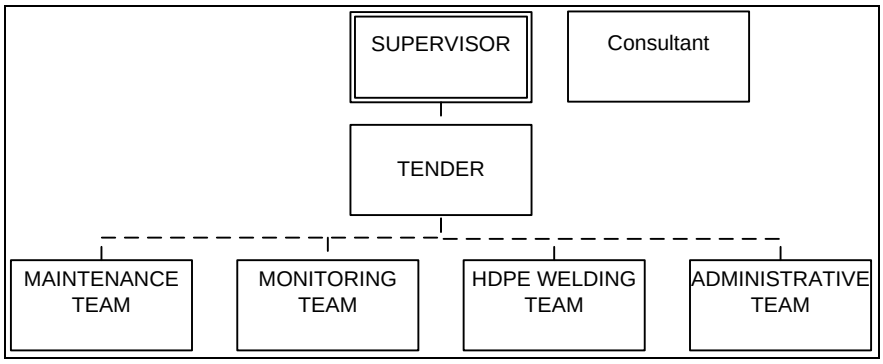

Figure 15 – Organizational structure for the project activity, project management hierarchy

As per the implemented organizational structure valid during the 1st 7-year crediting period, the technical project staff of BATTRE has the following responsibilities:

CDM project consultant: Responsible for the monitoring report and general LFG process coordination.
CDM project supervisor: Supervise the LFG collections and destruction process.
CDM project tender: Operate the LFG station, storage data's and calibrations procedures and coordinate the maintenance, monitoring, welding and administrative team.
CDM project maintenance team: Responsible for the field maintenance and upgrade the LFG collection system.
CDM project monitoring team: Responsible for the wellhead monitoring/regulations and field report.
CDM project HDPE welding team: Responsible for the HDPE welding and pipes slope adjustments.
CDM project administrative team: responsible for operational internal reports and equipment calibrations.

Quality Assurance and Quality Control:

The project's LFG collection and destruction infrastructure (internally named as "biogas system") is part of the scope of the BATTRE's ISO 9001 and 14001 certified QA/QC/EMS systems. The quality assurance and environmental certification scopes for the operation of the LFG project are regularly audited and certified by third-party independent certification body. As per working procedures, all quality assurance and quality control measures are systematically followed by the project operational team.

Emergency procedures for the monitoring system:

BATTRE has created and implemented a set of precautions, safety and emergency procedures to ensure the integrity and safety for the monitoring process and overall project operation. The operation of the project's monitoring system is performed on the basis of equipment and instruments which may have spare (back-up) units and always follow documented maintenance and calibration schedules. Moreover, the project operational staff works in shifts thus assuring 24-hour support to the operation and maintenance of the project activity.

The occurred permanent post-registration change in the project design for the project activity (which is related to the consumption of LPG by the project activity) does not compromise the compliance of the previously designed monitoring plan with the applied methodology. The level of accuracy and completeness in overall monitoring of the project activity is not compromised by such change either. The permanent changes in the monitoring plan from the registered PDD encompassed by the previously revised version of the PDD (version 6, dated 27/12/2013) (which are summarized in Appendix 6) do not does not negatively compromise level of accuracy and completeness of the monitoring plan either.

B.7.4. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Completion date for revised version of the PDD (version 7):
28/01/2015:

Responsible entities / persons:

Mr. Mark Zulauf
ZLF Consultoria Sc Ltda.
São Paulo, Brazil
markzulauf@gmail.com

Nuno Barbosa
UniCarbo Energia e Biogás Ltda.
nuno@unicarbo.com.br
São Paulo, Brazil

Both ZLF Consultoria Sc Ltda. and UniCarbo Energia e Biogás Ltda. are CDM consulting and advisory services companies that supports the project participant BATTRE Bahia Transferencia e Tratamento de Resíduos S.A. with CDM related issues. These CDM consulting and advisory services companies are not project participants.

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
The assumed project starting date is 01/01/2004[59].

[59] The assumed project starting date is the same date as the selected starting date of the crediting period. The selected project starting date was defined in accordance with general CDM rules valid at the time the CDM validation assessment for the project activity was performed (period encompassing years 2004 and 2005). The selected project starting date is thus not in accordance with the definition of project starting date as defined by the later issued Glossary of CDM Terms.

C.1.2. Expected operational lifetime of project activity

>>
16 years.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
7-year renewable crediting period.

C.2.2. Start date of crediting period

>>
01/01/2004.

C.2.3. Length of crediting period

7 years and 0 months[60].

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
In accordance with applicable Brazilian environmental regulations, it is the responsibility of the environmental authority of the State (Bahia in the particular case of the project activity) to asses and approve the analysis of overall environmental aspects/impacts for initiatives in landfills. Such assessment/approval is performed in the context of applicable environmental licensing procedure for such initiatives. The environmental authority in Bahia State is the *Instituto do Meio Ambiente* (IMA/BA) (Bahia's State Environmental Affairs Institute).

The AMC landfill was built and has always operated under compliance with valid environmental licensing approvals and permits. In Brazil, in the particular case of environmental licensing for construction and operation of landfills, normally, the implementation of an initiative promoting forced extraction of LFG and its combustion in high temperature enclosed flares (using active LFG collection and destruction systems) do not require any dedicated or separated additional environmental licensing procedure (including development and approval of an Environmental Impact Assessment (EIA)) [61] . Thus, no additional licensing effort was required for the implementation of the project activity encompassing LFG collection and destruction.

[60] In December 2013, while the 1st 7-year renewable crediting period for the project activity (from 01/01/2004 to 31/12/2010) was already expired, there were pendent CER issuance requests for all the 6-year period from 01/01/2005 to 31/12/2010. Both this revised version of the PDD (version 7) and the previously revised version of the PDD (version 6) valid for the 1st crediting period of the project activity (which were compiled almost 4 and 3 years after the end of the such crediting period respectively) addressed the related requirements of the so-called *VVS track* regulatory framework for addressing post-registration changes (corrections in information which does not affected the project design + permanent changes in the monitoring plan of the project activity).

[61] This is in accordance with the licensing procedure currently adopted by environmental authorities from most of the Brazilian States. São Paulo State has been however an exception to this rule. In this State, the local environmental authority (named CETESB) has set specific additional requirements for licensing such LFG collection and destruction/utilization initiatives in some specific cases. In some cases, high temperature enclosed flares or engine-generator sets (using LFG as fuel for electricity generation) have been regarded as stationary

In summary, the expected environmental aspects of the project are positive (with minor negative environmental impacts) and they can be summarized as follows:

- The operation of the project activity has a positive influence on the local environment by promoting the destruction of pollutant gases like H_2S and derivatives of methane, mercaptenes and other chemical compounds that under high concentration level would promote bad odors and sanitary risks in the neighboring populations: such as diseases and asthma due to the air pollution.

- Efficient collection and destruction of LFG reduces risks of explosion in the landfill site. Indeed, in the presence of a specific proportion of oxygen, the methane contained in the landfill gas can become explosive. Due to that, the project activity has been operated with continuous monitoring and control of the oxygen content of collected LFG which is sent to the flare(s), thus continuously controlling the risk of explosions.

- The operation of enclosed high temperature flares can generate noise and vibration in case of operational problems. As part of the operation of the project activity, it has been ensured that the installed flares always operate in accordance with the operational requirements and conditions as established by the equipment manufacturer. That minimizes the occurrence of noise and vibration that could negatively affect working staff of the landfill and people living in the surrounding areas.

D.2. Environmental impact assessment

>>
As outlined in Section D.1, the development of an Environment Impact Assessment (EIA) was not required for the construction and operation of the project activity. Thus, no EIA for the project activity was ever developed prior or after the implementation of the project activity.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>
At the time of the project design initial conceptualization, local stakeholder consultation (with local stakeholders being invited for making comments and questions about the project activity) was performed as follows:

Official calls / reports announcing a Public Presentation of the project in 3 different local newspapers:

emission sources for local criteria pollutants (SO_x, NO_x, CO, etc.) and related monitoring of emissions has been a requirement set by CETESB.

- 27/09/2002: Advertisements/calls were published on the local newspapers "*Correio da Bahia*" (page E9); "*A Tarde*" (page N17). An advertisement/call was also published in the official press "*Diário Oficial do Estado da Bahia*" (page 4).
- 2/10/2002: Advertisements/calls were published on the local newspapers "*Correio da Bahia*" (page E9); "*A Tarde*" (page I15). An advertisement/call was also published in the official press "*Diário Oficial do Estado da Bahia*" (page 4).

A meeting with local press/media members was performed on 15/10/2002. The following persons participated on the meeting:

- Regina Bochicchio, reporter from "Correio da Bahia" (local newspaper);
- Mariana Machado, reporter from "TV Educativa" (Educational TV channel);
- Humberto Lima, reporter from "Rádio Sociedade" (a local radio station).

The main outcome of the meeting was announced in the local media as follows:

- Article published at "*Correio da Bahia*" newspaper on 16/10/2002, Environment section page 8;
- Television broadcasting at "*TV Educativa*" TV channel on 15/10/2002;
- Broadcasting at "*Rádio Sociedade*" radio on 15/10/2002.

A public meeting/presentation was organized with the local stakeholders. The table below summarizes the persons/entities presented at the meeting:

BATTRE	
Artur Tanuri	BATTRE Director
Florent Mailly	Vega Engenharia Ambiental Project Officer
Octavio Nunes	Vega Engenharia Ambiental Marketing and Communication Manager

PRESS	
Vinicius Clay	Correio da Bahia

ONGs	
Fundação ONDAZUL	Leandro Amaral Responsible for ONG

PUBLIC AUTHORITIES	
Jalon Santos Oliveira	SESP Salvador
Rilda Bloise	SESP Salvador
Everaldo Carvalho Silva	SESP Salvador
Ana Maria de Oliveira	LIMPURB
Pedro Roberto Rabelo	LIMPURB
Leda Maria Pinto de Oliveira	SESP Lauro de Freitas
Péricles João dos Santos de Jesus	SESP Simões Filho
Maria de Fátima Espinheira	CONDER
Osvaldo Mendes Filho	CONDER
Sergio Figueiredo	CONDER
Maria de Fatima	CONDER
Josevaldo Costa Ramos	IBAMA/BA
José Guilherme da Mota	IBAMA

PRIVATE SECTOR ENTTIES	
Sean Bradley	Ecosecurities / Globo MVO
Thierry Gisbert	Sita Tech – França
Anesio Fernandes	Clube de Engenharia
José Maria Duarte	Embala Ind. Com. Ltda.
Pedro Ribeiro	Stewart & Stevenson
Marcio Pereira de Souza	Tractebel Energia S/A

UNIVERSITY (ACADEMIA)	
Marcelo Theoto Rocha	ESALQ/USP
Arthur Penna	UNEB/FAPES
Luiz Mozinio	UFBA
Sarah Ladeira	UFBA
Adalto Azevedo Jr.	UFBA
Miriam Carvalho	UFBA/UCSAL
Sandro Lemos Machado	UFBA
Severino Soares Agra Filho	UFBA
Arilma Oliveira do Carmo	UFBA
Carolina Torres Menezes	UFBA
Atonio Alves Dias	UFBA
Mario Sergio Soares May	UFBA
Ronaldo Bruno Leal	UNIFACS
Wanderley Jr.	UNIFACS

A form for stakeholder comments on the project distributed among the participants during the presentation.

BATTRE (formerly “Vega Engenharia Ambiental”) prepared a material which was made available on its internet site (www.vega.com.br). The material included a briefing of the project and an e-mail address (Vega Bahia.MDL@vega.com.br) for which stakeholder comments were to be submitted.

During the public presentation, a cooperation agreement was signed between BATTRE and CEPEA (Center of economic research of the University of São Paulo). The purpose is to develop a mutual technical and scientific cooperation, exchange of experience, consulting, trainning and suport regarding the subject “Landfills and climate change – how to improve biogas management”. At that time CEPEA was working on a project for the Environment State Department to estimate the potential of renewable energy generation from landfills in Brazil with the cooperation of BATTRE.

E.2. Summary of comments received

>>
Technical comments about the potential for CER generation of the project activity were raised and were addressed by the CDM consultancy service company MGM International.

E.3. Report on consideration of comments received

>>

At the time of the CDM validation of the project activity, comments/position from MGM international were made available to the DOE in charge of the validation assessment. At that time, the PDD was actually edited in order to better address comments/position from MGM and also to address a related Correction Action Request (CAR) raised by the DOE in charge of the validation assessment.

SECTION F. Approval and authorization

>>

A Letter of Approval (LoA) from the Designated Operational Entity (DNA) of host Party Brazil was issued on 02/06/2004. This LoA confirms the voluntary participation of the former project participant Vega Bahia Tratamento de Resíduos Ltda[62] and Brazil in the CDM and confirms that the proposed project activity contributes towards Sustainable Development in Brazil. The project was also granted with an LoA from the DNAs of Japan (LoA dated 12/01/2005), United Kingdom of Great Britain and Northern Ireland (LoA dated 20/04/2005) and the Netherlands (LoA dated 31/08/2006).

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[62] The name of the host country Project participant was later replaced by Bahia Transferencia e Tratamento de Resíduos S.A. (BATTRE).

Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	BATTRE: Bahia Tranferencia e Tratamento de Residuos S.A.
Street/P.O. Box	Estrada Cia-Aeroporto, km 6.5
Building	
City	Municipio de Salvador
State/Region	Estado da Bahia
Postcode	41.505-050
Country	Brazil
Telephone	+ 55.71.491.8488
Fax	
E-mail	atanuri@vega.com.br
Website	www.vega.com.br ; www.sita.com ; www.suez.com
Contact person	
Title	CEO
Salutation	Mr.
Last name	Radel
Middle name	Quintas
First name	Lucas
Department	Bahia Transferencia e Tratamento de Residuos S.A.
Mobile	
Direct fax	+ 55.11.6165.3561
Direct tel.	+ 55.11.6165.3574
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Shell Trading International Limited
Street/P.O. Box	80 Strand
Building	80 Strand
City	London
State/Region	
Postcode	WC2R 0ZA
Country	United Kingdom
Telephone	+44 20 7546 5000
Fax	+44 20 7546 5134
E-mail	Roon.osman@shell.com
Website	http://www.shell.com
Contact person	
Title	CDM manager
Salutation	Miss
Last name	Osman
Middle name	
First name	Roon
Department	Environmental Products Trading Business
Mobile	+44 7984 767 099
Direct fax	+44 20 7546 5134
Direct tel.	+44 20 7546 5126
Personal e-mail	Roon.osman@shell.com

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Showa Shell Sekiyu K.K.
Street/P.O. Box	3-2, Daiba 2 chome, Minato-ku
Building	Daiba Frontier Building
City	Tokyo
State/Region	
Postcode	135-8074
Country	Japan
Telephone	+ 81-3-5531-5627
Fax	+ 81-3-5531-5767
E-mail	Takashi.Hasegawa@showa-shell.co.jp
Website	www.showa-shell.co.jp
Contact person	
Title	GHG manager
Salutation	Mr.
Last name	Hasegawa
Middle name	
First name	Takashi
Department	New Business Development Division
Mobile	
Direct fax	+ 81-3-5531-5767
Direct tel.	+ 81-3-5531-5627
Personal e-mail	

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Electrabel S.A.
Street/P.O. Box	Boulevard du Régent 8
Building	-
City	Brussels
State/Region	
Postcode	B-1000
Country	Belgium
Telephone	32 (0) 2 518 61 11
Fax	32 (0) 2 518 6297
E-mail	Lieven.bloeyaert@electrabel.com
Website	www.electrabel.com
Contact person	
Title	Head of Environmental Markets
Salutation	Mr.
Last name	Bloeyaert
Middle name	
First name	Lieven
Department	Environmental Trading
Mobile	
Direct fax	32 (0) 2 518 62 97
Direct tel.	32 (0) 2 501 59 94
Personal e-mail	Lieven.bloeyaert@electrabel.com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	ZLF Consultoria Sc Ltda
Street/P.O. Box	Rua Portugal, 828
Building	
City	São Paulo
State/Region	SP
Postcode	04559-002
Country	Brazil
Telephone	5571 3289 3623
Fax	
E-mail	markzulauf@gmail.com
Website	
Contact person	Mark Zulauf
Title	Director
Salutation	
Last name	Zulauf
Middle name	Rudolf
First name	Mark
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	markzulauf@gmail.com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	UniCarbo Energia e Biogás Ltda.
Street/P.O. Box	Alameda Joaquim Eugênio de Lima, 598 – 53
Building	
City	São Paulo
State/Region	São Paulo, SP
Postcode	01403-000
Country	Brazil
Telephone	+ 55 11 9 8596 0950
Fax	+ 55 11 9 8596 0950
E-mail	nuno@unicarbo.com.br
Website	www.unicarbo.com.br
Contact person	
Title	Mr.
Salutation	
Last name	Barbosa
Middle name	
First name	Nuno
Department	
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2. Affirmation regarding public funding

Not applicable. The implementation and operation of the project do not involve any kind of public funding from Parties included in Annex I.

Appendix 3. Applicability of methodology and standardized baseline

While all information about the applicability of selected methodology are presented in Section B.2, this appendix includes relevant information about the following issues:

- Reasons for not any longer considering specific provisions of AM0002 for determining project emissions and thus applying a more appropriate approach for determining ex-post annual values for the monitoring parameter "Amount of methane destruction in the absence of the project activity as per contractual agreement" ($CH4_{contract,y}$)
- Version translated into English language of the official communication issued by the Administration of the Municipality of Salvador (municipal authority) confirming the values for the parameter $CH4_{contract,y}$ valid for years 2005, 2006, 2007, 2008, 2009 and 2010
- Implementation of utilization of LFG as gaseous fuel for electricity generation (in a 20.1 MW electricity generation facility) which represents an occurred permanent post-registration change in the project design which is valid in the context of the yet to be renewed 2nd 7-year crediting period for the project activity (from 01/01/2011 to 31/12/2017)

Reasons for not any longer considering specific provisions of AM0002 for determining project emissions and thus applying a more appropriate approach for determining ex-post annual values for the monitoring parameter "Amount of methane destruction in the absence of the project activity as per contractual agreement" ($CH4_{contract,y}$)[63]

Potential non-fully compliance with all applicability conditions of AM0002 (version 1) (which is addressed as post-registration changes):

As per AM0002 (version 1), the methodology is applicable to *"landfill gas capture and flaring project activities where:*

(i) There exists a contractual agreement that makes the operator responsible for all aspects of the landfill design, construction, operation, maintenance and monitoring;

(ii) The contract was awarded through a competitive bidding process;

(iii) The contract stipulates the amount of landfill gas (expressed in cubic meters) to be collected and flared annually by the landfill operator;

(iv) The stipulated amount of landfill gas to be flared reflects performance among the top 20% in the previous five years for landfills operating under similar social, economic, environmental and technological circumstances; and

(v) No generation of electricity using captured landfill gas occurs or is planned."

[63] The whole content of the clarification box highlighting the potential non-fully compliance of the project design with all applicability conditions of AM0002 (version 1) combined with explanations of the reasons for applying a more appropriate methodological approach for monitoring the parameter $CH4_{contract,y}$ was previously submitted to the CDM-EB in the form of a Request for Clarification (applying the form "*CDM: Form for submission of queries from DOEs to the Methodologies Panel regarding the application of approved methodologies (version 01) - (To be used by DOEs for presenting questions / proposals / amendments related to the applicability of approved methodology)".* The submission was performed in April 2012 by the DOE in charge of the still ongoing 2nd, 3rd, 4th, 5th and 6th periodic verifications for the project activity in year 2012. As a response to the submission, the project participant BATTRE was informed by the CDM-EB methodological panel (through the DOE) that the issues related to the potential non-fully compliance with specific applicability condition of AM0002 (version 1) and the use of a more appropriate approach for determining ex-post annual values for the monitoring parameter $CH4_{contract,y}$ were to be addressed via applicable procedure for addressing post-registration changes. The previously revised version of the PDD (version 6, dated 27/12/2013) addressed these issues as post-registration change.

Furthermore, the methodology states that:

(vi) *"It is assumed that the contract specifies both the quantity of waste projected to be disposed at the landfill during each year ($WASTE_{contract,y}$) and the quantity of landfill gas (LFG) required to be flared during each year. The amount of methane required to be flared each year ($CH4_{contract,y}$) is the quantity of LFG required to be flared as per the contract multiplied by an appropriate methane content to give a conservative baseline."*

It is crucial to note that only applicability conditions (i), (ii) and (v) were actually met at the time of the project registration as a CDM project activity.

Regarding applicability condition (iii): Differently than suggested at the Validation Report for the project activity (issued in December 2005), the contractual agreement that granted the landfill concession to BATTRE, which was valid before and has remained valid after the date of project registration, does not actually define the amount of LFG to be collected and flared annually in the baseline scenario.

Thus, in order to meet related methodological requirements, the amount of LFG to be collected and flared annually (parameter $CH4_{contract,y}$) is monitored *ex-post* on the basis of an official communication issued by the Administration of the Municipality of Salvador (which is the public entity (municipal authority) that has established a public concession service contractual agreement with PP for Municipal Solid Waste (MSW) collection and disposal services)[64].

Regarding applicability condition (iv): the demonstration of compliance within the specified requirement is based on conditions and data of landfills which were commissioned after the date of registration of the project activity.

More appropriate approach for determining ex-post annual values for the monitoring parameter "Amount of methane destruction in the absence of the project activity as per contractual agreement" ($CH4_{contract,y}$):

BATTRE initially highlights the importance to note that as stated in both AM0002 (version 1) and the registered PDD, the amount of methane to be destroyed due to contractual reasons/requirements in the absence of the CDM project activity (baseline scenario) is defined as follows:

"*(…) the amount of methane to be flared which reflect performance in terms of collection and destruction of LFG in landfills using passive LFG destruction systems among the top 20% in the previous five years for landfills operating under similar social, economic, environmental*

[64] The official communication/declaration issued by the Administration of the Municipality of Salvador (municipal authority) dated 20 August 2010 (of which copy (+ translation into English language) is made available in Appendix 3) includes annual values of $CH4_{contract,y}$ valid for the AMC landfill for years 2005 - 2010. According to this communication, the outcome of an independent technical study/evaluation (published in 2010 by Companhia Ambiental do Estado de São Paulo – CETESB, which is the environmental authority for São Paulo State in Brazil) were taken into consideration by the technical staff from the Administration of the Municipality of Salvador for defining the set of annual values for the parameter $CH4_{contract,y}$. It should be noted that conducting an assessment of the stipulated amount of landfill gas to be flared against the performance of the top 20% landfill sites in the previous five years (from the date of concession contract signature in 1999) is no longer feasible for the Administration of the Municipality of Salvador, even though it is an applicability condition required by AM0002 (version 1). On the other hand, the parameter $CH4_{contract,y}$ is considered a monitoring parameter (parameter to be monitored ex-post). Thus, the existing incongruities between AM0002 (version 1) and the monitoring plan of the previous version of the registered PDD (version 5 dated March 2005) result in these atypical methodological issue which was addressed as post-registration changes in the previously revised version of the PDD (version 6, dated 27/12/2013).

and technological circumstances."

This requirement reflects the conceptualization approach for the *ex-post* determination of baseline emissions at the time of the design of AM0002 (version 1) and later compilation of the PDD. The project participant BATTRE also acknowledges and highlights the following regarding the *ex-post* determination and monitoring of the calculation parameter $CH4_{baseline,y}$ and the monitoring parameter $CH4_{contract,y}$, respectively, as well as the earlier adopted estimations for the quantity of methane required to be flared regardless of the project activity (in the context of the determination of *ex-ante* estimations of emission reductions in the registered PDD):

1) The baseline and monitoring methodology AM0002 (version 1) and the previous version of the registered PDD (version 5 dated March 2005) were both designed in a very beginning phase of the CDM. The Salvador da Bahia Landfill Gas Management Project (which is the only CDM project for which AM0002 is applicable) was actually the first LFG collection and destruction project initiative ever submitted as a proposed CDM project activity. In the context of the baseline emission determination, as per AM0002 methodology, the amount of methane that would be assumed as captured destroyed in the absence of project activity (baseline scenario) was at that time defined by considering a public concession contract established between Vega Bahia Tratamento de Resíduos S.A. and the Administration of the Municipality of Salvador (municipal authority). This contractual agreement was established during the earlier occurred concession process and construction phase of the AMC landfill. Due to this reason, the title of AM0002 is "*Greenhouse gas emission reductions through landfill gas capture and flaring where the baseline is established by a public concession contract*".

2) This public concession contract (dated 29 December 1999) establishes terms and conditions for MSW collection and disposal services to be provided by BATTRE for the Municipality of Salvador. It is imperative to understand that this contractual agreement actually does not specify any quantitative or percentage amount of methane to be collected and flared using a passive LFG destruction system (in the absence of the project activity)[65].

3) Prior to the signature of the concession contractual agreement for MSW collection and disposal between BATTRE and the Administration of the Municipality of Salvador (municipal authority), BATTRE has compiled and submitted a technical proposal document with technical details about its MSW management offer package. This technical document describes *inter alia* the use of passive conventional LFG collection system in the AMC landfill. However, no quantitative amount (absolute or percentage values) of methane to be collected and flared using a passive conventional LFG destruction system with LFG venting/combustion drains (in the absence of the project activity) are indicated in this document either[66]. However, it is imperative to observe that it is clearly stated that given all uncertainties and lack of information, the quantitative amount of methane to be collected and flared using a passive conventional LFG destruction system (in the absence of the project activity) were to be later confirmed.

4) In the context of the occurred tendering process for the public concession service involving collection and disposal of MSW in the city of Salvador, under the requirements of the Federal Law Nº 8.666, dated 21/06/93, it was required to Vega Bahia Tratamento de Resíduos S.A. (former name of the project participant BATTRE) to demonstrate

[65] Copy of the official contract for MSW collection and disposal signed between the BATTRE and the Administration of the Municipality of Salvador (municipal authority) was made available to the DOE's assessment team.

[66] Copy of the technical proposal document issued by BATTRE was made available to the DOE

economic & financial equilibrium for its technical and commercial offer comprising collection and disposal of MSW in the Municipality of Salvador. While the commercial and technical offer of Vega Bahia Tratamento de Resíduos S.A. was mainly based on remuneration for the MSW collection and disposal services (based on specific tariff in Brazilian Reais currency) applicable for a measured ton of MSW actually collected and disposed, in order to reach a an economic attractiveness level for the offer (as explicitly required by Federal Law Nº 8.666), potential CER revenues due to the implementation of a active and efficient forced LFG collection and destruction system (by flaring and/or electricity generation using collected LFG as fuel) under the CDM were thus also considered in the context of such demonstration of economic & financial equilibrium.
As per the studies and investigations conducted at the time by Vega Bahia Tratamento de Resíduos S.A. (which were based on somehow limited knowledge about the real potential for LFG generation and its collection and utilization), it was estimated, in a conservative manner, that a CDM project activity comprising improvement in LFG collection efficiency from 20% (assumed conservative LFG collection efficiency for a well designed passive conventional LFG collection system in the absence of the project) to 80% (assumed LFG collection efficiency for a well designed the active forced LFG collection and flaring system being implemented as a CDM project activity) would generate a given annual CER stream. By also adopting forecasted values for CER prices, amount of generated electricity and forecasts of electricity sale tariff, the overall economic & financial equilibrium for the enterprise (involving MSW collection and disposal + collection and destruction/utilization of LFG) was sufficiently demonstrated as required by Federal Law Nº 8.666. By adopting such estimations of incremental revenues due to commercialization of CERs, the project participants managed to demonstrate that their MSW collection and disposal operations at the AMC landfill would be economically attractive.

5) At the time all the information elements and assumptions included the previous version of the registered PDD (version 5 dated March 2005) was designed (period from year 2001 to year 2005), Vega perceived the requirement of estimating the amount of emission reductions to be achieved by the project activity along the crediting period (7 years x 3). In order to sufficiently meet this requirement, it was assumed in the context of the *ex-ante* estimation of emission reductions along the crediting period that, in the absence of the project, a passive LFG collection and destruction system with estimated methane destruction efficiency of 19% to 24% would be implemented. The same assumptions would be implemented in the absence of the project under performance conditions as earlier estimated in earlier compiled study for demonstrating economic & financial equilibrium for the enterprise (involving MSW collection and disposal + collection and destruction/utilization of LFG).

6) It is important to note that while as per AM0002 (version 1), the parameter $CH4_{contract,y}$ is assumed as required to be monitored *ex-post*, the assumed 19-24% range ratio value was thus considered merely in the context of the *ex-ante* estimation of emission reductions (value of 20% of estimated total LFG to be collected was actually used) in the previous version of the registered PDD. The previously revised version of the PDD (version 6, dated 27/12/2013) includes a more appropriate approach for the ex-ante estimates of emission reductions[67]. It is also crucial to take into account that also at the time of the compilation of the previous version of the registered PDD (version 5) and

[67] By taking into account the relative limitations of the methodological approach of AM0002 (version 1), the ex-ante estimate of methane generation at the AMC landfill is performed by applying applicable approach of the methodological tool "Emissions from solid waste disposal sites" (version 06.0.1). Such alternative approach promotes more accurate and correct estimates of emission reductions (without affecting the amount of baseline emissions to be determined ex-post as part of the application of the project's monitoring plan + applicable GHG calculations. Further details are included in Section B.6.3 and in the emission reduction calculation spreadsheet enclosed to this PDD.

development of AM0002 methodology, Vega Bahia Tratamento de Resíduos S.A. and the Administration of the Municipality of Salvador (municipal authority) had a very limited knowledge about how to quantify performance of passive LFG collection and destruction systems in order to define a more suitable the value/share of LFG to be considered as required to be destroyed by the passive conventional LFG destruction/venting system. Anyway, at that time, in order to fully meet the requirements of AM0002 and requirements for completing the PDD, *ex-ante* estimation of emission reductions was thus calculated by adopting estimations of the share of LFG (with 50% CH_4 content) also estimated to be collected and sent to the flares (under the project scenario) as equal to the quantify of methane that would be collected and flared by using a "*well designed and operated*" passive conventional LFG destruction system in the absence of the project. These estimates at that time attempted to consider in a very conservative and optimistic way the theoretical performance of a very good passive conventional LFG collection and destruction system that *would* represent the top 20% (in the previous five years) for landfills operating under similar social, economic, environmental and technological circumstances (as required by AM0002).
Such requirement in AM0002 (which was actually proposed by BATTRE) aimed to ensure the conservativeness of emission reductions and baseline determination estimates.
It is also important to note that relevant knowledge or statistics about "*destruction of LFG in top 20% of comparable landfills in Brazil"* were unfortunately not available at that time either.

7) At the time of the compilation of both AM0002 and the initial version of the PDD, the *ex-ante* estimation of emission reductions are determined by applying the formulae below:

$$CH4_{contract,y} = LFG_{projected,y} * CH4/LFG_{contract} * FD_y$$

Where:
FD_y is the fraction of landfill gas captured and flared as specified by the contract. In the particular context of the *ex-ante* estimation of emission reduction, FD_y was thus assumed/estimated as a 19-24% range (value of 20% was actually used) which was equal to the value estimated by BATTRE in its study for demonstrating economic & financial equilibrium for its technical and commercial offer comprising collection and disposal of MSW in the Municipality of Salvador. This estimated value was not defined by the Administration of the Municipality of Salvador (municipal authority) and were not included in signed contractual agreement as a requirement or condition. As it consider the projected (estimated) amount of LFG to be collected by the project activity ($LFG_{projected,y}$), this formulae is only valid for the calculation of $CH4_{contract,y}$ in the context of *ex-ante* estimation of emission reductions. As earlier emphasized, the signed contractual agreement does not specify any amount of methane to be collected and flared using a passive LFG destruction system (in the absence of the project activity).

8) More recently, the project participant BATTRE, the Administration of the Municipality of the Salvador, scholars from the Brazilian academy, as well as other independent stakeholders hopefully had developed a much better understanding about the real performance of passive conventional LFG collection and destruction systems in landfills in developing countries (such as Brazil). This competence development is actually a positive outcome of the CDM in Brazil. While as per the currently applicable environmental regulations in Brazil, there are still no legal requirements to destroy LFG in landfills by passive LFG capture systems, a quite comprehensive study dealing with this particular issue was finally published at the website of CETESB (the environmental authority of São Paulo State) in May 2010. This technical study analyses and derives (in a very comprehensive, detailed and sufficiently conservative manner) the theoretical maximum potential performance (in terms of LFG combustion) of best-practice passive conventional LFG capture systems as per the conditions available in Brazil. This independent study allowed both the Municipality of Salvador and BATTRE to finally

confirm that the *ex-ante* estimations for the monitoring parameter $CH4_{contract,y}$ (work performed about 9 years ago) were indeed completely overestimated.

9) By taking into account that (i) AM0002 (version 1) clearly defines that the amount of methane that would have to be captured destroyed in the absence of project (baseline scenario) is established by a public concession contract; and (ii) by also assuming that as per the registered PDD, the value of parameter $CH4_{contract,y}$ is to be monitored *ex-post*; the Administration of Municipality of Salvador has thus defined the applicable values for parameter $CH4_{contract,y}$ through a official communication (dated August 2010) which represents a complementation to the contractual agreement for MSW collection and disposal service earlier signed by both parties in December 1999.

10) In the context of the definition of applicable the values for the parameter $CH4_{contract,y}$, the Administration of Municipality of Salvador fully acknowledges that the conclusions of the independent technical study were considered for defining the value of the parameter $CH4_{contract,y}$ for annual periods (years 2005, 2006, 2007, 2008, 2009 and 2010).
The findings of the study "*Magalhães, G.HC.; Alves, J.W.S.; Santo Filho. F.; Kelson, M. Reducing the uncertainty of methane recovered (R) in greenhouse gas inventories from waste sector and of adjustment factor (AF) in landfill gas projects under the Clean Development Mechanism. Paper issued on 27 May 2010"*(webhosted at the CETESB website:
http://www.cetesb.sp.gov.br/userfiles/file/mudancasclimaticas/biogas/file/docs/artigos_dissertacoes/magalhaes_alves_santofilho_costa_kelson.pdf) were thus taken into account.

It is also noteworthy that "2006 IPCC guidelines" takes into account measurements in 11 closed landfill sites (where the collection efficiency is greater than collection efficiency in operational landfill site) with an average collection efficiency of 37% for active LFG collection and destruction systems. While an active LFG and collection system avoid the LFG leakage/emission through the surface of the landfill by creating a negative pressure gradient (suction) in the landfill cells, in the case of passive LFG collection and destruction systems (without LFG suction and without use of enclosed high temperature flares) the maximum potential LFG destruction efficiency is thus by far lower. That denotes that the conclusions from the considered study are reasonable and correct.

11) It is also crucial to note that the definition of values of $CH4_{contract,y}$ by Administration of the Municipality of Salvador (municipal authority) is a completely independent decision from this governmental entity. While there is no regional or national legislation requiring LFG to be collected and destroyed in landfills in Brazil, the selected value basically represents the maximum technically possible share of generated LFG that could be destroyed by the use of a hypothetical very well engineered and operated passive conventional LFG collection and flaring system.
By making a integrative comparison between the AM0002 (version 1) against the more recent version of ACM0001 (up to version 11) comparable CDM methodology, it is to be noted that the selected value (which indeed represents about 5% of all collected LFG by the project activity) is in line (within the same range) with the % value for the comparable ACM0001's parameter Adjustment Factor AF selected for other also comparable LFG collection and destruction/utilization project initiatives in Brazil and under the CDM (using more recent versions of ACM0001 methodology). This is outlined in the table below:

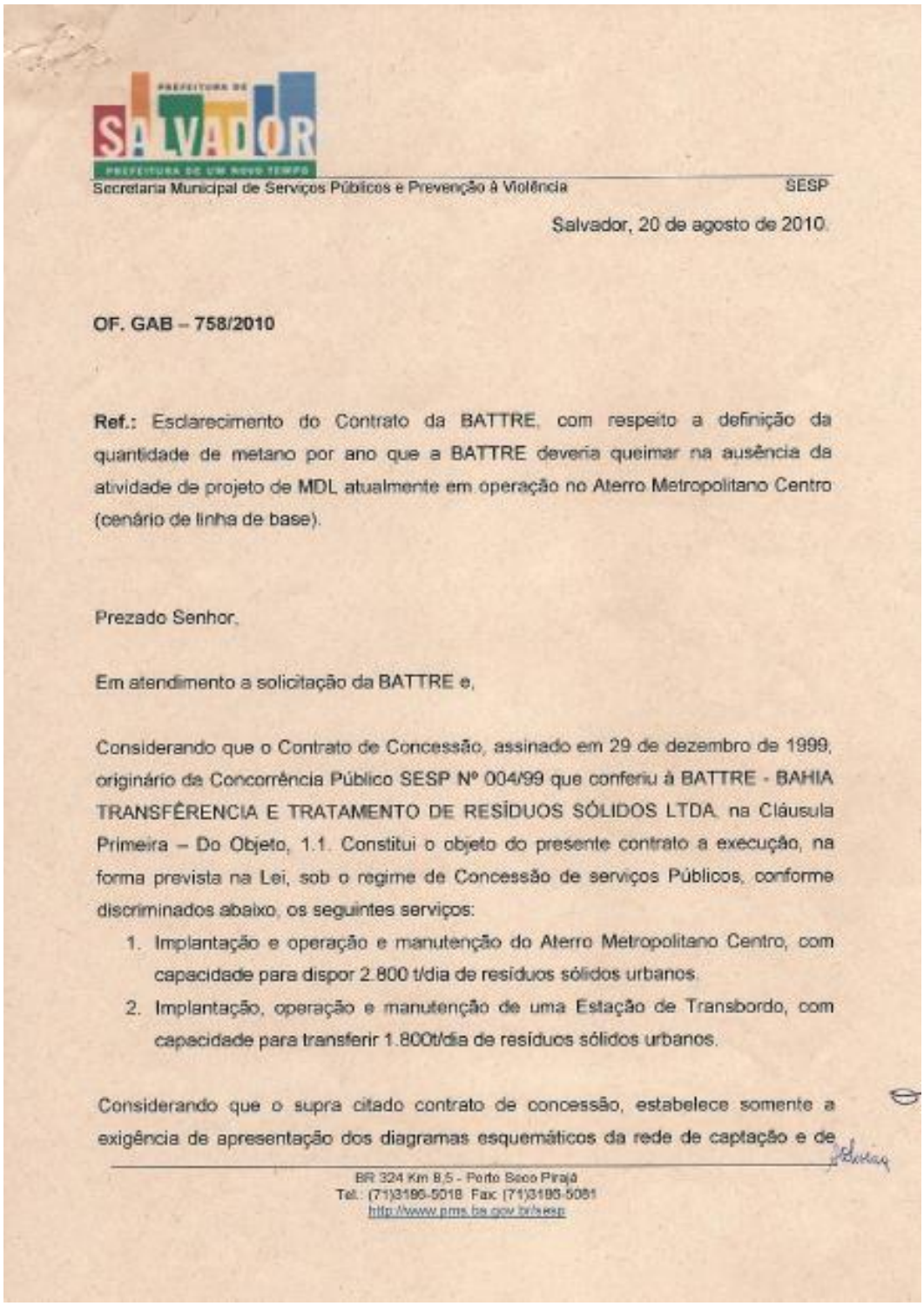
Selected values of AF for LFG collection and destruction/utilization projects in Brazil more recently proposed under the CDM (well managed landfills)

Project Number	*Project Title*	*Selected value for ACM0001's parameter Adjustment Factor (AF)*
2548	*Gramacho Landfill Gas Project*	*5.0%*
1491	*CTRVV Landfill emission reduction project*	*7.0.%*
1506	*Proactiva Tijuquinhas Landfill Gas Capture and Flaring project*	*10.0%*
- (under validation in April 2012)	*CTL Landfill Gas Project*	*0.54%*
- (under validation in April 2012)	*CGR Guatapara Landfill Project*	*9.71%*
(under validation in April 2012)	*Corpus/Araúna – Landfill Biogas Project*	*2.8%*
3464	*Exploitation of the biogas from Controlled Landfill in Solid Waste Management Central – CTRS / BR.040*	*5.0%*
4211	*Manaus Landfill Gas Project*	*0 % (zero)*
4657	*Itaoca Landfill Gas Project*	*0 % (zero)*
3958	*CTR Candeias Landfill Gas Project*	*0 % (zero)*

Copies of all related documentation to the explanative items above were made available to the DOE's assessment team.

Official communication issued by the Administration of the Municipality of Salvador (municipal authority) confirming the values for the parameter $CH4_{contract,y}$ valid for years 2005, 2006, 2007, 2008, 2009 and 2010 (including its translation into English Language)

Copy of the communication (dated 20/08/2010) is presented below:



Secretaria Municipal de Serviços Públicos e Prevenção à Violência SESP

Salvador, 20 de agosto de 2010.

OF. GAB – 758/2010

Ref.: Esclarecimento do Contrato da BATTRE, com respeito a definição da quantidade de metano por ano que a BATTRE deveria queimar na ausência da atividade de projeto de MDL atualmente em operação no Aterro Metropolitano Centro (cenário de linha de base).

Prezado Senhor,

Em atendimento a solicitação da BATTRE e,

Considerando que o Contrato de Concessão, assinado em 29 de dezembro de 1999, originário da Concorrência Público SESP Nº 004/99 que conferiu à BATTRE - BAHIA TRANSFÊRENCIA E TRATAMENTO DE RESÍDUOS SÓLIDOS LTDA. na Cláusula Primeira – Do Objeto, 1.1. Constitui o objeto do presente contrato a execução, na forma prevista na Lei, sob o regime de Concessão de serviços Públicos, conforme discriminados abaixo, os seguintes serviços:

1. Implantação e operação e manutenção do Aterro Metropolitano Centro, com capacidade para dispor 2.800 t/dia de resíduos sólidos urbanos.
2. Implantação, operação e manutenção de uma Estação de Transbordo, com capacidade para transferir 1.800t/dia de resíduos sólidos urbanos.

Considerando que o supra citado contrato de concessão, estabelece somente a exigência de apresentação dos diagramas esquemáticos da rede de captação e de

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drenagem de gás de aterro gerado no AMC, com a Cláusula Décima Primeira – Responsabilidades, Obrigações e Direitos da Concessionária: 11.20 - Antes da entrada em operação do Aterro Sanitário Metropolitano Centro, fornecer os projetos executivos das obras e instalações, acompanhados da indicação dos respectivos responsáveis técnicos, no mínimo: 11.20.9 – Plantas do sistema de captação, drenagem, e remoção do biogás gerado, com os respectivos detalhes, cores, indicação dos métodos construtivos e materiais utilizados, sem que haja manifestação sobre o assunto do biogás;

Considerando que até a presente data não existe legislação federal, estadual e municipal vigente que obriga ou recomenda a captação e queima de gás (biogás) em aterros sanitários;

Considerando que na Proposta Técnica, parte integrante do contrato, define no item J.3.1 "Mecanismos de Produção do Biogás" que se faz necessário reconfirmar a produção de biogás ao longo da operação do aterro, em função dos parâmetros reais;

Considerando estudos recentes desenvolvidos pela Companhia de Tecnologia de Saneamento Básico (CETESB), entidade de reconhecida competência técnica no Brasil, que estimam quantitativamente a emissão passiva da queima de biogás em lixões, aterros controlados e em aterros sanitários, em um rol de 35 cidades do Brasil, utilizando formas de cálculo das emissões passivas de metano e que representa boas práticas exercidas no setor de disposição de resíduos;

Considerando a nota técnica da CETESB, o volume de CH_4, assim demonstrado no Quadro I, em condições normais de temperatura e pressão;

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PREFEITURA DE SALVADOR
PREFEITURA DE UM NOVO TEMPO

Secretaria Municipal de Serviços Públicos e Prevenção à Violência SESP

Quadro I - Volume de Metano - CH4 (Nm^3)

Ano	Volume de Metano-CH4 (Nm^3)
2005	1.971.601
2006	2.349.427
2007	1.890.050
2008	2.064.097
2009	1.790.928
2010	1.533.000

Nota: Os dados acima estão nas condições normais de temperatura e pressão (CNTP).

As informações acima apresentadas e os dados Quadro1, respaldam que esse novo quantitativo de metano coletado e queimado está adequado.

Atenciosamente,

Angela Maria de Oliveira
Assessora da ASPLA
LIMPURB

Fábio Mota
Secretário

Ilmº. Sr.
Reinaldo Bomfim de Carvalho
Diretor da BATTRE – Bahia Transferência e Tratamento de Resíduos S.A.
Nesta.

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Salvador, 20th August 2010

TRANSLATION OF THE COMMUNICATION OF .GAB – 758/2010 ISSUED ON 20 AUG. 2010

Ref.: Clarification about Battre's contractual agreement, with respect to definition of yearly quantity of methane that BATTRE shall destroy in the absence of the CDM project activity currently under operation in the landfill site Aterro Metropolitano Centro (baseline scenario).
Dear Sir,

In response to a request from BATTRE and,

By considering that the concession contract, signed on 29 December 1999, resulted from the public tendering process SESP004/99 which allow BATTRE – BAHIA TRANSFERÊNCIA E TRATAMENTO DE RESIDUOS SÓLIDOS LTDA, in its first clause - Object 1.1. It is the object the contract the execution, as per applicable legislation, under the regime of concession of public service, as described below, the following services:

1. Implementation, operation and maintenance of the landfill Aterro Metropolitano Centro, with municipal solid waste disposal capacity of 2,800 ton/day.
2. Implementation, operation and maintenance of a waste transfer station with municipal solid waste transferring capacity of 1,800 ton/day.

By considering that the referred concession contract only establishes as requirement, the presentation and submission of schematic diagrams of the system for collecting and drainage of landfill gas generated at AMC landfill as per Clause XI –"Responsibilities, Rights and Obligations of the Concessionaire"; 11:20 – Prior to the operation starting of the Aterro Metropolitano Centro landfill, the executive project of construction work and installation shall be submitted, with indication of respective responsible technicians enclosed at least; 11.20.9 – Diagrams and drawings of biogas drainage and collection system, with its specification details, cones, indication of the construction methods and utilized materials, without any requirement of manifestation about biogas issue.

By considering that up to present date, there is no federal, state or municipal legislation requiring or recommending capture and combustion of biogas from landfills;

By considering that as indicated in the Technical Proposal, as part of the contract documentation, defines in its item J.3.1 "Biogas Production Mechanisms", that it is required to re-confirm biogas production along the operation of the landfill, depending on the actual parameters;

By considering that recent studies developed by Companhia de Tecnologia de Saneamento Básico (CETESB), which is an organization of recognized technical expertise in Brazil, which it is quantitatively estimated the emission due to combustion of biogas in passive flares in dump sites, controlled landfill and sanitary landfills located in 35 Brazilian cities , using calculation approach for determination of passive emissions of methane and of which represent good practice on solid waste disposal;

By considering the technical note from CETESB, the CH4 volume, as demonstrated in Table 1, under standard temperature and pressure:

Table 1 – Volume of methane (Nm^3)

Year	Volume of Methane (Nm^3)
2005	1.971.601
2006	2.349.427
2007	1.890.050
2008	2.064.097
2009	1.790.928
2010	1.533.000

Note: The above data is converted to standard temperature and pressure.

The above presented information and data as per Table 1, supports that this new quantitave definition of amount of methane collected and destroyed is appropriate.

Sincerely,

Fabio Mota
Secretary

Implementation of utilization of LFG as gaseous fuel for electricity generation (in a 20.1 MW electricity generation facility) which represents an occurred permanent post-registration change in the project design which is valid in the context of the yet to be renewed 2nd 7-year crediting period for the project activity (from 01/01/2011 to 31/12/2017)

At the time of the project's initial design conception (period from year 2002 to 2003), utilization of LFG as fuel for electricity generation was indeed considered. However, as result of performed studies and evaluations for defining the final design of the project activity, this potential LFG alternative was discarded[68]. This is outlined in Section B.4.

In this context it is relevant to highlight that the following information was also added in the previous version of the registered PDD (version 5 dated March 2005) in order to substantiate such previous potential utilization of collected LFG (as gaseous fuel for electricity generation) as part of the project design:

"An additional key element of the contribution to sustainable development is the option that the project will provide to subsequently install landfill gas to energy (LFGTE) equipment that could produce electricity on the schedule shown in Table 1. As mentioned above, although the LFGTE element of the project might be eligible for CERs, it is being excluded from the calculation of CERs because its timing is uncertain, to make the project calculation more straightforward, and to use the most conservative baseline possible. Substitution of fossil fuel-based electricity by electricity generated from renewable sources is, however, another potential sustainable development benefit of the project.

(…)

Potential Installation of Capacity and Estimated Electricity Production

Year	*Installed Power*	*Annual electricity production (MWh)*
2004-2005	*8 MW*	*63,000*
2006-2008	*16 MW*	*126,000*
2009-2013	*24 MW*	*189,000*
2014-2018	*32 MW*	*252,000*
2019-...	*40 MW*	*315,000*

(…)"

In the methodology proposed by BATTRE, it was indicated as applicability condition the following:

> *"Energy production from landfill gas captured in addition to contractual amount will not happen without CDM project activity"*

As a matter of fact, there is a possibility to produce energy from the LFG. At the moment, generation is not economically feasible due to technical questions related to gas capture and low energy prices. However, as it has a strong sustainable development factor, and

[68] It is important to note that, at the time of the project design initial conceptualization, upon the decision of the project participant BATTRE (former not any longer consider utilization of collected LFG as gaseous fuel for electricity generation, the CDM-EB has thus approved and published AM0002 (version 1) without consideration of such utilization of collected LFG.

since reduction of risk exposure can be achieved with CDM, it is still possible that BATTRE can implement an energy generation project.
If this occurs for such a project, it becomes necessary to have a complete review of the baseline study to determine if the energy generation would modify the hypotheses of the present CDM activity, i.e. if the energy generation would have occurred without the CDM activity."

Further information/clarification from the project participant BATTRE about the implementation of a new 20.1 MW electricity generation facility as a change in the design of the registered project activity which is valid for the 2nd 7-year crediting period

However, for purpose of enhancing transparency and completeness,this section aims to provide general details, explanations and further clarification about the implementation of a new 20.1 MW electricity generation facility as an occurred change in the design of the CDM project activity "Salvador da Bahia Landfill Gas Management Project" which is valid and applicable in the context of the yet to be renewed crediting period from 1 January 2011 to 31 December 2017 (and thus not valid/applicable for the 1st crediting period). This change is yet to be addressed through the revision of the PDD valid for the 2nd 7-year crediting period. This Appendix also includes selected pictures of the implemented new 20.1 MW *state-of-the-art* electricity generation facility (in operation since 1 January 2011).

Box 3: "Salvador da Bahia Landfill Gas Management Project": a pioneer project-based GHG emission reduction initiative under the CDM

The registered CDM project activity "Salvador da Bahia Landfill Gas Management Project" was one of the first GHG emission reduction initiatives ever being proposed in the framework of the CDM worldwide. The initial discussions to implement the project as an emission reduction project-based initiative under the Kyoto Protocol have initiated by year 2000 (even prior to the official publication of the Marrakesh Accords!). Later, it was the responsibility of the project participants of this pioneer project based initiative under the CDM flexible mechanism to actually elaborate and propose to UNFCCC the methodological and conceptual design of the first new baseline and monitoring methodology for destruction of LFG rich in methane. The proposed new baseline and monitoring methodology NM0004 was later approved (in 26 September 2003) by UNFCCC as "AM0002 – Greenhouse gas emission reductions through landfill gas capture and flaring where the baseline is established by a public concession contract" - version 01.

AM0002 was actually one of the first CDM methodologies ever being proposed and submitted to UNFCCC. While AM0002 represents the second CDM methodology ever approved by UNFCCC, it is actually the first approved baseline and monitoring methodology comprising emission reductions from abatement of methane emissions. Furthermore, the compilation of the PDD for the "Salvador da Bahia Landfill Gas Management Project" also represents one of the first initiatives worldwide related to the development of a PDD under the CDM.

CDM documentation for the "Salvador da Bahia Landfill Gas Management Project" (incl. the registered PDD and AM0002 methodology) was elaborated and approved in the context of the relative initial "*learning-by-doing*" phase of the CDM by years 2003 to 2005. About 8 years after the development and approval phase of AM0002.
The inclusion of the new the new 20.1 MW electricity generation facility also represents a pionner initiative of BATTRE. The new power plant is the most advanced electricity generation facility using LFG as fuel in the whole country of Brazil. At the time of the implementation of the power plant and its start of operations on 01/01/2011, there were only two other large LFG project initiatives in Brazil with collected LFG being used as gaseous fuel for electricity generation. The CDM project activities "Bandeirantes Landfill Gas to Energy Project – (BLFGE)" (UNFCCC registration number 0164) and the "São João Landfill Gas to Energy Project (SJ)" (UNFCCC registration number 0373)

both encompass electricity generation with large scale power plants (with nameplate capacity of 22.2 MW and 25.6 MW respectively). These power plants utilize engine-generator sets which do not yet include the very advanced electronic control system such as the new *state-of-the-art* GE-Jenbacher, JMS 320 GS engine-generator sets which were installed in the new electricity generation facility located in the AMC landfill in Salvador, Brazil.

1.1 The technical evaluation and decision taking process which resulted in the implementation a new 20.1 MW electricity generation facility powered by LFG as a modification in the design of the registered project activity

The table below provides a timeline for all relevant events and facts which are related to the whole decision taking process and implementation process for the new electricity generation facility powered by LFG which was built as a modification in the design of the registered project activity "Salvador da Bahia Landfill Gas Management Project".

Timeline including relevant events for the implementation of a new 20.1 MW electricity generation facility powered by LFG as a modification in the project design of the project activity

2007-2008	After implementing and operating the project activity as a LFG collection and destruction (by flaring) for more than 3 years, the project participant BATTRE and the company Solvi Valoração Energética (SVE)[69] have initiated the development of internal field studies and researches to promote the use the collected LFG as fuel for electricity generation (as a more rational and environmentally friendly solution than just flaring all collected LFG) as earlier considered in the initial phase of the project design (but not earlier implemented). Such internal researches ended up later resulting on a decision to have SVE establishing a joint-venture with BATTRE and investing about BRL 60,000,000 (about USD 38,000,000) for the implementation of a new renewable energy component for the "Salvador da Bahia Landfill Gas Management Project", thus finally promoting a more sustainable, environmentally friendly and rational use for LFG (as fuel for the generation of electricity). A complete set of technical, economical and commercial evaluations were performed by BATTRE and SVE during the period encompassing years 2007 and 2008. In all economical evaluations carbon revenues played an instrumental role for the implementation and operation of the whole project activity (including the new electricity generation component), when compared to the earlier initial construction phase of the project activity by years 2003-2004. The following technical aspects and conditions represented inter-alia the main drivers/reasons for finally taking the project's electricity generation component out of the ground: • less uncertainties about the quantity of LFG actually collected by the project activity after running the project activity for several years, • development of real field expertise/experience with collection of LFG by BATTRE after running the project activity for several years • learning-curve of available technology for use of LFG for electricity generation (incl. recent improvements in conversion efficiency of

[69] Both BATTRE and the company Solvi Valoração Energética (SVE) are companies which are part of Solvi Group. Solvi Group one of the leading groups in the field of waste management, water supply and waste water treatment in Brazil (and more recently in the fields of power generation and energy efficiency measures).

	engine-generator units, use of advanced electronics for dealing with usual fluctuations of CH_4 content in LFG, reduction of problems of synchronization of generated electricity within the electricity grid, etc.) • better electricity prices in Brazil (when compared to the situation in years 2003 and 2004) • relatively reduced prices for imported power generator equipment in local currency (due to the verified relative valuation of the Brazilian Real against the US dollar and Euro) when compared to the situation in years 2003 and 2004 • reduced policy and market uncertainties in the Brazilian power market when compared to the situation in years 2003 and 2004 • overall improvement in macroeconomic conditions in Brazil (reduction of currency exchange rate oscillations, economic growth, reduced county risk indexes, better investment environment, proper addressing of inflation, etc.) when compared to the situation in years 2003 and 2004 • improved local financing conditions and rules
5 March 2008	The global and experienced CDM consultancy company "MGM International" was selected by BATTRE and SVE to analyze and secure the eligibility of the implementation of the new power plant in the context of the registered project activity "Salvador da Bahia Landfill Gas Management Project". Under the terms of the signed CDM consultancy service provision contract, MGM International became in charge of developing all related CDM documentation for the inclusion of the electricity generation component as a modification of the design of the registered CDM project activity (including PPD).
17 March 2008	The final decision to implementation of the electricity generation facility was formally taken by the Board of Directors BATTRE and SVE on 17 March 2008 with the establishing of the enterprise/company "Usina Termelétrica SVE Salvador S.A." (also denominated "Termoverde"). "Termoverde" is established as joint-venture between BATTRE and SVE. "Termoverde" was created with the goal to purchase LFG from BATTRE, generate electricity and sell electricity as per the applicable rules of the Brazilian power market.
30 April 2008	The technical solution involving the use of engine-generator sets supplied by the American/Austrian power generation equipment manufacturer GE-Jenbacher AG was regarded by Termoverde as the most suitable technical alternative for electricity generation among other evaluated options.
26 June 2008	An Engineering, Procurement and Commission (EPC) agreement was finally signed between Termoverde and the Brazil based company STEMAC Energia Ltda. (representative in Brazil for the power generation equipment manufacturer and supplier GE-Jenbacher AG.) for the design, construction, commissioning and operation of a complete "*turn key"* and *state-of-the-art* new electricity generation facility with about 20.1 MW of installed capacity (using an expandable number of 19 (nineteen) engine-generator sets model GE-Jenbacher, JMS 320 GS with installed capacity of 1,060 kW each). It is noteworthy that no GE-Jenbacher engine-generator set has ever been previously installed in the whole South America by June 2008.
October 2008	Starting of construction phase for the new electricity generation facility by STEMAC Energia Ltda. in an area in the AMC landfill close to the existent LFG flaring station.
January 2011	

	1 January 2011: Start of operation of the new electricity generation facility. While taking into account the provision of the registered PDD, requirements and applicability conditions of AM0002 (version 1), ACM0001 (version 11)[70] and current applicable CDM rules for change in the design of registered CDM project activities, the project participant BATTRE has taken the strategic decision to only permanently connect the new LFG powered electricity generation facility to the project activity (connection to the existent project's LFG pipeline (pipeline deviation between the blowers, main LFG flow meter and the installed flares) on 1 January 2011 (thus in the context of the yet to be renewed second 7-year crediting period). Thus, it is deemed correct to consider that during the whole crediting period from 1 January 2004 to 31 December 2010 the project has been implemented as a LFG collection and destruction (by flaring) initiative. No collected LFG has been utilized on a continuous basis for electricity generation as part of the CDM project operation during such initial 7-year renewable crediting period.
December 2011	BATTRE and the CDM consultancy company MGM International are currently (December 2011) still working on the development of a new PDD including: • utilization if ACM0001 (version 12) baselline and monitoring methodology[71]; • project description including the technical description of the new electricity generation facility; • determination of baseline scenario and baseline emissions by considering the new electricity generation facility; • assessment and demonstration of additionality by considering the the new electricity generation facility; • demonstration on how the applicability conditions of ACM0001 (version 12) are met by by considering the new electricity generation facility; • demonstration of serious CDM consideration in the context of the decision taking process for the new electricity generation facility; • etc.

1.2 <u>Applicable CDM procedures/rules for addressing the implementation of the new 20.1 MW electricity generation facility as a change in the project design of "Salvador da Bahia Landfill Gas Management Project":</u>

As per applicable CDM procedures, a PDD for the 2nd 7-year crediting period of the project activity will be compiled and will be assessed by a DOE. This PDD will apply the latest version of ACM0001 – "Flaring or use of landfill gas", which is the CDM baseline and monitoring methodology of which AM0002 was consolidated into. The current latest version of ACM0001 is version 15.0.0 ACM0001 (version 12.0.0) included the following disclaimer:

[70] ACM0001 (version 11) was the latest version of ACM0001 at the time.

[71] An earlier draft version of the new PDD applying ACM0001 (version 11) was earlier developed and submitted to UNFCCC as part of its communication highlighting the interest of BATTRE to renew the crediting period for the project activity. However, as a result of the publication of more recent versions of ACM0001 (version 15.0.0 is the latest version), a new PDD adopting this more recent version of ACM0001 will be submitted for validation of renewal of crediting period as established by applicable CDM rules and procedures.

"*If during the project activity the project participant wishes to change the use of the captured LFG, for instance from flaring to energy generation, then the latest version of the"Procedures for notifying and requesting approval of changes from the project activity as described in the registered Project Design Document" must be applied.*"

Although this disclaimer is not included in ACM0001 (version 15.0.0), it is also valid for a project activity applying this more recent version of ACM0001. The disclaimer above is in accordance with the CDM Project Standard and CDM Project Cycle Procedure. Therefore, based on the yet to be assessed new PDD for the 2nd 7-year crediting period of the project activity (applying ACM0001 (version 15.0.0), an edited/revised version of such PDD will be compiled by including the new electricity generation facility as a permanent post-registration change in the project design.

3.4 Other occurred changes in the project design (inter alia in order to meet ACM0001 monitoring requirements):

Apart of the changes in the project design related to the implementation of the new 20.1 MW electricity generation facility, some changes in the LFG flaring station were also implemented in October 2010 in order inter-alia to make the project monitoring in accordance with specific requirements of the latest version of ACM0001 baseline and monitoring methodology (version 15 is currently the latest version of ACM0001), which is the monitoring methodology to be adopted in the framework of the second 7-year renewable crediting period initiated on 1 January 2011. The performed additional recent modifications include:

- Installation of dedicated LFG flow meters for each one of the 2 flares currently under operation.
- Installation of a secondary CH_4/O_2 concentration gas analyzer unit for monitoring the CH_4 content and O_2 concentration of the exhaust gas of the flares.
- Changes in the LFG pipeline design in the section in the LFG flaring station (in order to allow correct installation of additional flow meters – respecting a minimum required distance between the flow meters and the pipeline curves)
- Changes in the configuration/design of the blower and condensation traps
- Modifications in the PLC unit (for dealing with additional measurements)
- Design of a completely new data acquisition, data recording and data reporting solution package (in accordance with all data measurement/recording/reporting of the latest version of ACM0001
- Scrapping of one of existent 3 enclosed flares after 7 years of utilization

5 Selected pictures of new 20.1 MW electricity generation facility and current configuration of the LFG destruction facility

For the purpose of enhancing transparency and completeness of information about the current operational status of the project activity, this section includes selected pictures of the implemented new 20.1 MW electricity generation facility (in operation since 1 January 2011).

Picture A1 – View of the LFG destruction facility (in the new operative configuration) and view of the new 20.1 MW electricity generation facility (picture dated February 2011).

Picture A-2 – View of the new facility for treatment (cooling) of LFG used for the electricity generation (picture dated February 2011)

Picture A-3 –View of one of the new 19 (nineteen) *state-of-the-art* GE-Jenbacher, JMS 320 GS Engine-generator sets which were installed in the new electricity generation facility (picture dated February 2011)

Picture A-4 –View of the currently installed project's power substation (for exporting generated electricity to the National Electricity Grid of Brazil), (picture dated February 2011)

Appendix 4. Further background information on ex ante calculation of emission reductions

As outlined in Section B.6.3, additional details (incl. related calculations) about the ex-ante calculation of emission reductions are presented in an emission reduction calculation spreadsheet which is enclosed to this PDD.

Appendix 5. Further background information on monitoring plan

All information about the design and operation of the monitoring plan are presented in Section B.7.1 and B.7.2

Appendix 6. Summary of post registration changes

Summary of post-registration changes:

Version 7 (dated 28/01/2015)
In January 2015, the project participant BATTRE completed the revision of the PDD. The latest version of the CDM-PDD form (version 05.0) was applied by following the applicable requirements as established by the attachment document "Instructions for filling out the Project Design Document form for CDM project activities". The revised PDD addresses minor issues which are regarded under the category "Corrections (that do not affect the project design)" of post-registration changes. The revised version of the PDD (version 7) includes the following post-registration changes:

- Corrections (that do not affect the project design):

    (i) Inclusion of missing table with monitoring details for the monitoring parameter "*Amount of grid electricity consumed by the project activity during the year y*" ($EC_{grid,y}$) in Section B.7.1. (It is important to note that, as outlined below in the summary of post-registration changes valid for version 6 of the PDD (dated 27/12/2013), the inclusion of $EC_{grid,y}$ as an additional monitoring parameter in the monitoring plan for the project activity was already performed as part of such previous revision of the PDD).
    (ii) Removal of a duplicate table with monitoring details for the monitoring parameter "Quantity of LPG consumed by the project activity" ($FC_{LPG,y}$) from Section B.7.1.

Version 6 (dated 27/12/2013)
In December 2013, the project participant BATTRE completed a revision of the PDD. The latest version of the CDM-PDD form at that time (version 04.1) was applied. For the revision of the PDD, it was also fully considered applicable guidance of the latest version of the "Guidelines for completing the Project Design Document form" at the time (version 01.0)). This previously revised version of the PDD (version 6, dated 27/12/2013) addressed issues which were regarded as post-registration permanent changes to the project design, permanent changes in the monitoring plan as well as corrections (that do not affect the project design). This version of the PDD (version 6) included the following post-registration changes:

- Occurred permanent changes in the design of the project activity due to the following:
    (i) Consumption of Liquefied Petroleum Gas (LPG) by the project activity for igniting the installed high temperature enclosed flares (after temporary planned or unplaned interruptions of operation of the flares).

- Permanent changes from the registered monitoring plan and/or monitoring methodology due to the following:
    (i) More appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of grid-sourced electricity by the project activity (as per the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption") (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices);
    (ii) Appropriate approach for monitoring parameters required for determining leakage emissions due to the consumption of fossil fuel LPG by the project

activity (as per the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"[72]) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices);

(iii) Appropriate approach for determining project emissions from residual methane emissions due to flaring of LFG by the project activity (based on monitoring the CH_4 combustion efficiency in the project's high temperature enclosed flares) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices)[73];

(iv) More appropriate approach for determining the annual amount of methane that would be destroyed in the baseline scenario (absence of the project activity) (with related calculation approach also being included in the PDD in Section B.6.1 - Explanation of methodological choices). This needed change is based on applicable contractual requirements and data/information made available by the Administration of the Municipality of Salvador (municipal authority). By applying such revised monitoring approach, it is assumed that the quantitative value for the parameter $CH4_{baseline,y}$ is equal to the value for the monitoring parameter $CH4_{contract,y}$ for each year of the crediting period.

- Corrections (that do not affect the project design):

(ii) Correction of the value for ex-ante determined parameter "Conversion Factor" (CF). This parameter represents density for the greenhouse gas methane (CH_4).

(iii) Revision of ex-ante estimations of emission reductions to be achieved by the project activity during the 1st 7-year renewable crediting period. This revision is due to the following aspects:

- Application of more accurate values for organic content and amount of Municipal Solid Waste (MSW) historically disposed at the AMC landfill;
- Use of more appropriate approach for estimating the amount of methane to be generated at the AMC landfill and to be collected by the project activity. Such estimations are performed by applying a more recent and appropriated approach (as per the latest version of the methodological tool "Emission from solid waste disposal sites").
- Consideration of leakage emissions due to the consumption of both grid-sourced electricity and LPG by the project activity and
- Consideration of the correct value for the ex-ante determined parameter CF (density of methane).

(iv) Inclusion of descriptions of details of applicable monitoring procedures which are in place since the start of operations of the project activity (in Section B.6.3 – Other elements of monitoring plan)

[72] The revised approach for determining leakage emissions due to the consumption of grid-sourced electricity by the project activity also refers to the latest version of the "Tool to calculate the emission factor for an electricity system".

[73] It is important to note that AM0002 indeed requires project emissions from residual methane emissions from flaring of LFG by the project activity to be considered in the context of the emission reduction determination. The lack of this requirement in the previous version of the registered PDD is regarded as a deficiency. While the project activity operated during the whole 1st 7-year crediting period without an individual LFG flow meter installed for each installed high temperature enclosed flare, it is not possible to determine the flow of LFG (residual gas) sent to each flare. Due to that applicable guidance from the latest version of the methodological tool "Project emissions from flaring" (version 2) could not be applied for the determination of such emissions.

(v) Major general corrections/improvements in PDD texts and tables (that do not affect the project design) in order to improve the comprehension of the following project related aspects[74]:

- Description of the project actvity and applied technology (including more precise project location details, pictures, schematic figures, etc.)
- Description of applied methodological choices (incl. GHG calculations),
- Description of the previously identified baseline scenario + demonstration of additionality,
- Description of the previouly assessed environmental aspects/impacts
- Use of the latest version of the CDM-PDD form at the time (version 04.1) and its completion by applying the latest version of the "Guidelines for completing the Project Design Document form" (version 01.0) at the time[75]
- Clarification (added in Appendix 3) about the occurred permanent post-registration change in the project design which is valid in the

[74] It is the opinion of the CDM experts hired by BATTRE for the compilation of the previously revised version of the PDD (version 6, dated 27/12/2013) that both the previously registered version of the PDD (version 5 dated March 2005) and the CDM baseline and monitoring methodology AM0002 somehow reflect the "learning-by-doing" phase of the CDM during the years 2003 to 2005 (date when these documents were issued). In this sense, besides of addressing all the post-registration changes (which are summarized in Appendix 6), the revised PDD also includes a complete review of project related information (incl. project design description, description of methodological approaches, etc.). The performed complete review of project related descriptions aims to improve the overall comprehension of the project design, applied methodological approaches/choices both in terms of GHG calculations (e.g. determination of emission reductions achieved by the project activity) as well as in terms of applicable monitoring requirements and even relevant environmental aspects for the project activity.
When compiling this previously revised version of the PDD (version 6, dated 27/12/2013) (as a requirement to address the post-registration changes (about 10 year after the compilation of the previous version of the registered PDD), the project participant BATTRE (and its associated CDM consultants) faced significant difficulties on converting information made available in the previous version of the registered PDD into the revised version of the PDD (version 6, dated 27/12/2013). While the previous version of the PDD applied an initial and not even official CDM-PDD form), the whole structure and format of data/information included in the document had to be significantly changed/improved in order to sufficiently meet the currently valid requirements for completing the CDM-PDD form at the time (version 04.1) as required by applicable CDM rules. In order to maintain, under an acceptable level, the desired and required integrity (and originality) of previously compiled project design data/information (as made available in the previous version of the registered PDD) the project participant BATTRE and its CDM consultants took the decision to compile this previously revised version of the PDD (version 6, dated 27/12/2013) by performing all needed changes in the original text under a level which was seen as required to improve the overall structure/format of previously compiled information (but without changing relevant aspects of such descriptions). BATTRE hereby acknowledges that the previously registered version of the PDD valid for the 1st 7-year crediting period (version 5 dated March 2005) included significant grammar mistakes, problems with sentence structure and organization, etc. In this sense, regardless of the attempt of BATTRE to, under an acceptable level, maintain the integrity and originality of information made available in the previous version of the registered PDD, the previously revised version of the PDD (version 6, dated 27/12/2013) contained heavy amount of new texts, text editing's, new information format, etc. It was the goal of BATTRE to have this revised PDD version under compliance with the latest applicable guidance for completing the CDM-PDD form at the time (version 04.1). In summary, BATTRE believes that the way the PDD was revised promotes better comprehension of the project design and other project related aspects.

[75] In accordance with the valid and applicable CDM procedure for submissions of updated project documentation at the time of the compilation of the previously revised version of the PDD (version 6, dated 27/12/2013), the version of the CDM-PDD form (CDM-PDD form version 04.1) was the form applied in the context of the revision of the PDD. It is important to note that, at the time the previous version of the registered PDD (version 5, dated March 2005) was compiled (and was assessed/approved by both the DOE in charge of its CDM validation and by the CDM-EB), the existent rules and requirements for completing the CDM-PDD form (including the descriptions of the project design, applied technology, definition of project boundary, identification of the baseline scenario, demonstration of additionality for the project activity, etc.) were not as detailed and well-structured as the currently valid applicable CDM rules and requirements.

context of the yet to be renewed 2nd 7-year crediting period (from 01/01/2011 to 31/12/2017)[76].

- Clarification (added in Appendix 6) of the rationale for the relative delay (about 8 years!) on addressing the post-registration in a revised version of the PDD.

Rationale for the relative delay on addressing the post-registration in a revised version of the PDD

The post-registration changes of both revised versions of the PDD (version 6 and version 7) are proposed in the context of the 2nd periodic verification for the project activity (monitoring period form 01/01/2005 to 31/12/2005). The PDD was firstly revised about 8 years after the monitoring period for the 2nd periodic verification. Such long delay on progressing with a CER verification is acknowledged by BATTRE as being quite unusual in the context of the CDM. Thus, for sake of transparency, BATTRE hereby makes it publicly available a set of events and facts, which are regarded as the main reasons for such occurred and not desirable long delay. The frame below includes a detailed timeline which aims to explain in an objective way the reasons for the occurred relative long delay for performing the 2nd periodic CER verification of the project activity (which as per the current CDM rules required a revision of the PDD for addressing post-registration changes).

Timeline of relevant events for the period CER verification of the project activity "Salvador da Bahia Landfill Gas Management Project"

December 2005	Issuance of CERs for the 1st periodic verification (monitoring period from 1 January 2004 to 31 December 2004).
September 2008	BATTRE has established a contractual agreement with the DOE SGS United Kingdom Limited (SGS) to perform the 2nd periodic CER verifications (comprising a 3-year monitoring period from 1 January 2005 to 31 December 2007).

[76] As explained in Appendix 3, since 01/01/2001 the project activity also promotes utilization of collected LFG as gaseous fuel for electricity generation in a new 20.1 MW electricity generation facility. This occurred permanent post-registration change in the project design is valid in the context of the yet to be renewed 2nd 7-year crediting period (from 01/01/2011 to 31/12/2017) and will be addressed as per applicable CDM rules and procedures in the yet to be registered PDD valid for the 2nd 7-year crediting period.

From February to September 2009	As part of the verification assignment (monitoring period from 1 January 2005 to 31 December 2007), an initial desk review of the Monitoring Report (and supporting documentation) was finalized by the DOE SGS and an on-site visit to the project site was conducted by members of the appointed verification team of this DOE. As part of its technical assessment, the DOE SGS has *inter-alia* questioned the project participants about the correctness of the adopted value for the *ex-post* determined grid emission factor for the Brazilian National Electricity Grid (used to calculate leakage emissions due to the consumption of grid-sourced electricity by the project activity). This raised issued has caused a significant delay in the whole verification process, as BATTRE (and other project participants of CDM project activities hosted in Brazil) has been facing serious problems in properly address this issue. *The issue about calculating and validating the official Emission Factor for the national electricity grid of Brazil:* Since year 2008 the DNA of Brazil has published an official value for the combined margin CO_2 emission factor fr the electricity grid of Brazil entirely on the basis of confidential data and calculation using dispatch analysis calculation approach. Thus, while detailed calculation for the *ex-post* monitored parameter Grid CO_2 emission factor ($EF_{grid,CM}$) was not possible to be enclosed to the Monitoring Report / emission reduction spreadsheet calculation as required by CDM rules, it has been not possible for the DOE SGS and other DOEs to confirm whether the determination of the value for the grid emission factor for the National Electricity Grid of Brazil was in full compliance with the requirements of the "Tool to calculate the emission factor for an electricity system". Thus, while the DNA of Brazil has chosen an approach to calculate and publish their own country grid emission factors on the basis of confidential and/or proprietary data, it was indeed not possible for any project participant of grid-connected CDM project activity hosted in Brazil to make such calculation details available in the Monitoring Report as established by applicable CDM rules. During several recent meetings of the CDM-EB, the issue of how to validate ex-post determined emission factor of the electricity grids for cases where calculations are based on confidential data (such as the case of the electricity grid of Brazil) has been extensively discussed by the members of the CDM-EB.
From September 2009 to December 2009	The DOE SGS was unfortunately under “suspension” status by the CDM-EB during the period from September 2009 to December 2009. Although, as per information from the CDM-EB, the DOE SGS was indeed authorized to continue working on their on-going CDM validation and/or verification assessments during such suspension period, it is noteworthy that during this whole period under which SGS was with “suspended” status, BATTRE was not informed and have not noticed any relevant progress from the DOE SGS regarding the remaining steps of particular the on-going verification assessment (assessment of responses to raised CARs/CLs, assessment of updates in the Monitoring Report and supporting documents, compilation of Verification Report, etc).
November 2009	While awaiting the finalization of the 2nd periodic verification by the DOE SGS, the project participant BATTRE has signed a contractual agreement with the DOE Germanischer Lloyd Certification GmbH (GLC) for the performance of the sequential 3rd periodic verification for the “Salvador da

	Bahia Landfill Gas Management Project" (2-year monitoring period from 1 January 2008 to 31 December 2009).
January 2010	As part of the its verification assessment, the DOE GLC has verbally informed the project participant BATTRE that, as established by the Clean Development Mechanism Validation and Verification Manual (VVM), GLC could not conclude the verification prior performing its DOE assessment of *"remaining issues and findings from the previous monitoring period (1 January 2005 to 31 December 2007)"*. Thus, the delay in the 2nd periodic verification being performed by the DOE SGS (monitoring period 1 January 2005 to 31 December 2007) has also reflected in an also very undesirable delay in 3rd periodic verification being performed by the DOE GLC (monitoring period 1 January 2008 to 31 December 2009). It is noteworthy that by December 2010, the "Salvador da Bahia Landfill Gas Management Project" had been operated for about 5 years without issuance of CERs (the only revenue source for the project).
May 2010	While the relative long delay on the issuance of CERs for the pendent 6 years of crediting period (year 2005 to year 2010) has obviously created a very strong negative impact in the overall financial results for the project activity, this situation has put BATTRE in severe difficulties in the context of earlier signed CER commercialization commitments/agreements with the Annex-I project participants. Moreover no progress within the on-going 2nd periodic verification by the DOE SGS was perceived by the BATTRE either. By taking into account these 2 undesirable aspects, as an attempt to speed up the CER issuance process, BATTRE has thus taken the decision to unilateral terminate the on-going verification with the DOE SGS in order to be able to select a new DOE to perform such verification which suffered about 2 years of delay and was far to be finalized (based on the perception of BATTRE). The project participant BATTRE have thus taken the decision to re-initiate the whole verification process for the period 1 January 2005 to 31 December 2007 by also using the technical verification/certification services of the DOE GLC.
July 2010	In order to formally terminate verification contractual agreement with BATTRE for the performance of periodic verification (monitoring period 1 January 2005 to 31 December 2007), upon request of BATTRE, the DOE SGS thus sent to the CDM Secretariat a formal notification of termination of the verification in question. This notification included a request of termination of the verification at a UNFCCC level (removal/withdraw of the initial version of the Monitoring Report previously made available at CDM website by the CDM Secretariat).
November 2010	The received request for the termination of periodic verification (monitoring period from 1 January 2005 to 31 December 2007) was finally processed by the CDM Secretariat. .
November 2010	Upon the formal termination (at UNFCCC level) of the verification contractual agreement between BATTRE and the DOE SGS, the project participant BATTRE has thus finally managed to sign a set of contractual agreements with the DOE GLC encompassing performance of periodic verifications for the following monitoring periods: - 1 January 2005 to 31 December 2005 - 1 January 2006 to 31 December 2006

	- 1 January 2007 to 31 December 2007 (BATTRE has internally agreed upon splitting the monitoring period from 1 January 2005 to 31 December 2007 into the 3 sequential monitoring periods of one year each).
December 2010	The DOE GLC initiated its 3 periodic verifications by performing a completeness check and webhosting the Monitoring Reports at UNFCCC website (monitoring periods from 1 January 2005 to 31 December 2005, 1 January 2006 to 31 December 2006 and from 1 January 2007 to 31 December 2007). The 3 new Monitoring Reports were made available at UNFCCC CDM website in December 2010.
January-February 2011	On 24 and 25 January 2011, an on-site assessment to the project site was performed by the appointed verification team of the DOE GLC in the context of the verification assessments for the monitoring period from 1 January 2005 to 31 December 2005. As a result of the initial desk review and conducted on-site visit, a list with the identified outstanding issues / findings (lists of raised CARs and CLs) for the first verification assessment was later submitted by the DOE GLC to BATTRE on 3 February 2011.
Since February 2011	BATTRE has worked with specialized CDM consultants in order address all identified outstanding issues (CARs and CLs). That included addressing the post-registration changes encompassed by the previously revised version of the PDD (version 6, dated 27/12/2013).
September 2014 – January 2015	BATTRE has worked with specialized CDM consultants in order address the additionally identified post-registration changes encompassed by this revision of the PDD (version 7).

Documented evidences for all the relevant events above are available. The timeline above highlights that due to reasons completely out of BATTRE's control and influence; the project participants for the project activity "Salvador da Bahia Landfill Gas Management Project" have suffered a very long and undesirable delay for the whole verification and CER issuance process involving achieved emission reductions during the whole period from 1 January 2005 to 31 December 2010 (6 years of reported emission reductions).

During this 8-year period encompassed by the occurred delay, real GHG emission reductions of magnitude beyond 2,500,000 tCO_2e were achieved and so far no Certified Emission Reduction (CER) was issued!
As CER revenues represents the only potential revenue stream for the "Salvador da Bahia Landfill Gas Management Project" along the whole initial 7 years of the project operation (since the project operation starting date in March 2004 until 31 December 2010), such complete absence of revenues has obviously created a big impact in the financials of this pioneer CDM project activity (which has faced quite substantial capital start-up investments as well as significant operation and maintenance costs along its operational time).

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Document information

Version	*Date*	*Description*
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;* • Editorial improvement.
04.1	11 April 2012	Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b
04.0	13 March 2012	Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8).
03.0	26 July 2006	EB 25, Annex 15
02.0	14 June 2004	EB 14, Annex 06b
01.0	03 August 2002	EB 05, Paragraph 12 Initial adoption.

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