CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Palmeras POME Co-composting Project
(hereinafter Palmeras Project or Project)
version 5, 24/09/2012

A.2. Description of the small-scale project activity:

This project activity is a co-composting project in Palmeras de la Costa, S.A., located in the region of Cesar, Colombia. Palmeras' palm oil mill was built in 1974 and processes the production of approximately 9,500 hectares of African palm plantations.

The process of crude palm oil production generates 3 types of solid waste: Empty Fruit Bunches (EFB), Mesocarp Fibres, and Palm Kernel Shells (PKS). Also, the liquid Palm Oil Mill Effluent (POME) with a high chemical oxygen demand is generated.

EFB is currently mulched and applied in the plantation, where it undergoes anaerobic and aerobic decomposition. Fibres and PKS are used in the palm oil mill's energy plant to generate electricity and steam. The mill is connected to the power grid; power requirements that are not generated through these renewable source onsite are purchased through the grid.

POME is currently treated in series of open lagoons before being discharged. During the anaerobic digestion in lagoons, methane gas is generated and emitted into the atmosphere. The lagoons are required to provide enough retention time to bring the COD of the wastewater down to the level of the local discharge standards.

The main objective of the project is to reduce the pollution potential of EFB and POME by implementing an aerobic composting process of its waste streams. It consists of co-composting EFB that would have been left to decay along with POME. The project activity will result in the avoidance of large quantity of methane that would have been released in an uncontrolled manner into the atmosphere from the anaerobic decay of EFB and POME.

EFB will be composted utilizing the Windrow technology in an onsite, covered composting plant. POME is added to the composting process to maintain adequate moisture level throughout the process cycle and provide additional nitrogen content for a compost rich in nutrients. Aerobic composting conditions will be assured through frequent turning of the compost piles with the Windrow turners and will be monitored through the compost quality control plan. The entire quantity of compost produced will be applied in the plantation.

This project contributes to sustainable development in various manners, including:

Environment	• Avoidance of methane emissions from anaerobic decay of EFB and POME.
	• Contribution to Colombia's national waste management strategy that places high priority in converting wastes into useful products.
	• Potential reduction in the use of chemical fertilisers and their life-cycle environmental impacts.
	• Sustainable soil management on the plantation.
Social	• Reduction of odours from the anaerobic decay of EFB and POME.
	• Job creation at the compost plant.
Economic	• New private investment in the compost plant.
	• New ongoing economic activity through composting.

A.3. Project participants:

Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be indicated using the following tabular format.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Colombia (host)	• Palmeras de la Costa S.A. (Private Company) • Aretech Cambio Climático S.A. (Private Company)	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Colombia

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

Cesar

A.4.1.3. City/Town/Community etc:

El Copey

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The new composting plant will be located on Palmeras' agro-industrial facility in the municipality of El Copey within the Department of Cesar. The map at the right shows the location of El Copey within Cesar and the location of Cesar within Colombia.

The mailing address for Palmeras' industrial facility is:

Palmeras de la Costa, S.A.
Carretera Vieja de Palmeras
El Copey
Cesar
COLOMBIA

The coordinates of the industrial facility are:

+10.0419º
-74.0436º

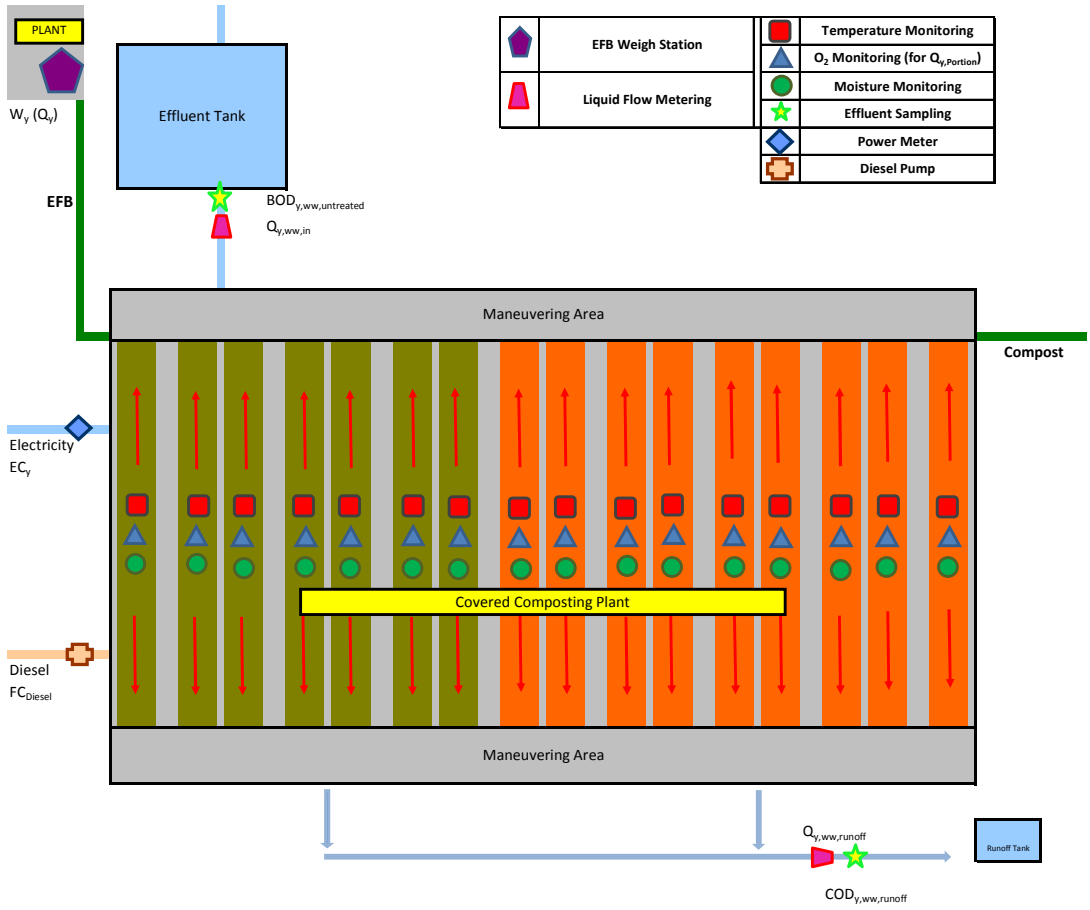
A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The project is a small scale project activity and falls under the category **III.F** according to the Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities. It is an "***Avoidance of methane emissions through composting***" project, diverting POME from anaerobic open lagoons without methane recovery to be used in an aerobic co-composting process with solid biomass waste.

The co-composting of EFB and POME will be carried out in a newly built composting plant adjacent to the existing wastewater treatment lagoons. The plant will occupy approximately 20 thousand square meters. The entire composting site will be protected from leachate by installing an impermeable membrane. Runoff water will be collected in concrete channels and pumped to one of the existing wastewater treatment lagoons for recycling to the compost piles, reutilization, and/or treatment prior to discharge. Because it can accommodate large volumes of wastes, "turned windrow" composting has been selected for the project activity. With this technique, the waste is arranged with mechanical loaders

in long narrow piles called "windrows". The windrows are turned regularly with specialized equipment to ensure aerobic composting conditions.

Following is a schematic diagram of the composting plant and its monitoring variables.



The compost plant design includes:

- Site preparation and impermeabilization
- Composting plant roofing
- Windrow compost pile turners
- POME spray system
- Runoff water management system
- Plant monitoring and auxiliary equipment

The aerobic composting is a controlled biological process in which a succession of microbial populations converts organic material into a biologically stable product. Composting is characterized by a microbially active thermophilic (high temperature, over 55ºC) period (called "active phase") while easily digestible materials are available, followed by a lower temperature period (called "curing phase") as more complex material are slowly digested. Under the presence of oxygen, micro-organisms, including bacteria and fungi, break down the organic matter into simpler substances. The effectiveness of the

composting process is influenced by the environmental conditions present within the compost (temperature, moisture, organic matter, oxygen and the size and activity of microbial populations). The entire composting process lasts 10 to 12 weeks.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Year	Estimation of annual emission reductions in tonnes of CO_2 e
2013*	35,557
2014	35,557
2015	35,557
2016	35,557
2017	35,557
2018	35,557
2019	35,557
Total estimated reductions (tonnes of CO_2 e)	248,897
Total number of crediting years	7
Annual average of the estimated Reductions over the crediting period	35,557

*Crediting period years as expected to start on 1 January and end on 31 December, as per section C.2.1.1
The basis for the estimated amount of emission reductions is described in section B.6.3.

A.4.4. Public funding of the small-scale project activity:

The project activity does not involve the use of public funding or official development aid.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

Based on paragraph 2 of Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, we confirm that the project activity is not a debundled component of a large project activity as the project participants did not register or apply for another small-scale CDM project activity:

- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology

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

The Project uses "Small-Scale Methodology III.F: Avoidance of methane emissions through composting", version 10.0. This methodology refers to "Small-Scale Methodology III.H: Methane

recovery in wastewater treatment", version 16.0 and to the Methodological Tool "Emissions from solid waste disposal sites", version 06.0.0. Also, the project activity uses other CDM tools for minor project emissions from incremental energy consumption.

B.2 Justification of the choice of the project category:

The project activity meets all of the relevant applicability criteria of AMS III.F v10.0:

AMS III.F	***Applicability Criteria***	***Project Activity***
Point 1	This methodology comprises measures to avoid the emissions of methane to the atmosphere from biomass or other organic matter that would have otherwise been left to decay anaerobically in a solid waste disposal site (SWDS), or in an animal waste management system (AWMS), or in a wastewater treatment system (WWTS).	The project activity will manage EFB that otherwise would have decayed anaerobically in a SWDS and POME that would have decayed anaerobically in a WWTS.
Point 1	In the project activity, controlled aerobic treatment by composting of biomass is introduced.	The project activity involves composting. Aerobic conditions are ensured through windrow turning.
Point 2	The project activity does not recover or combust landfill gas from the disposal site (unlike AMS-III.G "Landfill methane recovery"), and does not undertake controlled combustion of the waste that is not treated biologically in a first step (unlike AMS-III.E "Avoidance of methane production from decay of biomass through controlled combustion, gasification or mechanical/thermal treatment"). Project activities that recover biogas from wastewater treatment shall use methodology AMS-III.H "Methane recovery in wastewater treatment". Project activities involving co-digestion of organic matters shall apply methodology AMS-III.AO "Methane recovery through controlled anaerobic digestion".	The project activity does not include recovery or combustion of landfill gas combustion of the waste nor biogas recovery nor co-digestion of organic matters.
Point 3	Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	Estimated emission reductions are less that 60 kt CO_{2eq} annually. Please see sections B.6.3 and B.6.4.
Point 4	This methodology is applicable to the composting of the organic fraction of municipal solid waste and biomass waste from agricultural or agro-industrial activities including manure.	The EFP and POME treated by this project activity are biomass wastes generated by an agro-industrial activity. The project activity does not include municipal solid waste.

AMS III.F	*Applicability Criteria*	*Project Activity*
Point 5	This methodology includes construction and expansion of treatment facilities as well as activities that increase capacity utilization at an existing facility. For project activities that increase capacity utilization at existing facilities, project participant(s) shall demonstrate that special efforts are made to increase the capacity utilization, that the existing facility meets all applicable laws and regulations and that the existing facility is not included in a separate CDM project activity. The special efforts should be identified and described.	This project activity involves the construction of a new treatment facility (composting plant). Since the project activity does not propose to increase capacity utilization at an existing facility, the remaining criteria do not apply.
Point 6	This methodology is also applicable for co-composting wastewater and solid biomass waste, where wastewater would otherwise have been treated in an anaerobic wastewater treatment system without biogas recovery. The wastewater in the project scenario is used as a source of moisture and/or nutrients to the biological treatment process e.g. composting of empty fruit bunches (EFB), a residue from palm oil production, with the addition of palm oil mill effluent (POME) which is the wastewater co-produced from palm oil production.	This project activity involves co-composting wastewater and solid biomass waste and complies fully with the example in this applicability criterion: co-composting of EFB with POME.
Point 7	In case of co-composting, if it can not be demonstrated that the organic matter would otherwise been left to decay anaerobically, baseline emissions related to such organic matter shall be accounted for as zero, whereas project emissions shall be calculated according to the procedures presented in this methodology for all co-composted substrates.	Research carried out in Colombia demonstrates that the decay of solid organic matter (EFB) experiences anaerobic conditions[1]. Nevertheless, to be conservative, the baseline emissions for solid organic matter are accounted for as zero. The anaerobic lagoons clearly demonstrate that POME would otherwise decay anaerobically.
Point 8	The location and characteristics of the disposal site of the biomass, animal manure and co-composting wastewater in the baseline condition shall be known, in such a way as to allow the estimation of its methane emissions, using the provisions of AMS-III.G, AMS-III.E (concerning stockpile), AMS-III.D "Methane recovery in animal manure management systems" or AMS-III.H respectively.	The SWDS for biomass and the WWTS for co-composting wastewater are included in the project boundary. The remaining provisions for stockpiles and manure management do not apply to this project activity.

[1] Sierra, L., M. Gómez-Sarmiento & A. Varela. Effect of land use and climate on functional microbial groups in soils: Relation with edáficas variables. Ecuatorial Soils 39(1): 15-20. 2009. Note: This research article confirmed anaerobic decay conditions and cites two other works that found the similar results in other regions of Colombia.

AMS III.F	*Applicability Criteria*	*Project Activity*
Point 8	Project activities for composting of animal manure shall also meet the requirements under paragraphs 1, and 2(c) of AMS-III.D. Further no bedding material is used in the animal barns or intentionally added to the manure stream in the baseline. Blending materials may be added in the project scenario to increase the efficiency of the composting process (e.g. to achieve a desirable C/N ratio or free air space value), however, only monitored quantity of solid waste or manure or wastewater diverted from the baseline treatment system is used for emission reduction calculation.	Since the project activity does not include manure management, this criterion does not apply.
Point 8	The following requirement shall be checked *ex ante* at the beginning of each crediting period: (a) Establish that identified landfill(s)/stockpile(s) can be expected to accommodate the waste to be used for the project activity for the duration of the crediting period; or (b) Establish that it is common practice in the region to dispose off the waste in solid waste disposal site (landfill)/stockpile(s).	This criteria offers the option of demonstrating 8(a) or 8(b). This project selects option 8(a). Current practice is piling and mulching of solid waste on the plantations that supply the mills. Each hectare generates and then receives for mulching approximately 6 tons annually of EFB (25 t FFB[2] /ha-yr; 23% EFB/FFB). Therefore, the site can accommodate the waste for the duration of the crediting period.
Point 9	The project participants shall clearly define the geographical boundary of the region referred in paragraph 8(b), and document it in the CDM-PDD. In defining the geographical boundary of the region, project participants should take into account the source of the waste i.e. if waste is transported up to 50 km, the region may cover a radius of 50 km around the project activity. In addition, it should also consider the distance to which the final product after composting will be transported. In either case, the region should cover a reasonable radius around the project activity that can be justified with reference to the project circumstances but in no case it shall be more than 200 km. Once defined, the region should not be changed during the crediting period(s).	Option 8(a) is chosen above. Criterion 9 only applies when option 8(b) is chosen, and thus does not apply to this project activity.

[2] Fresh Fruit Bunches (FFB)

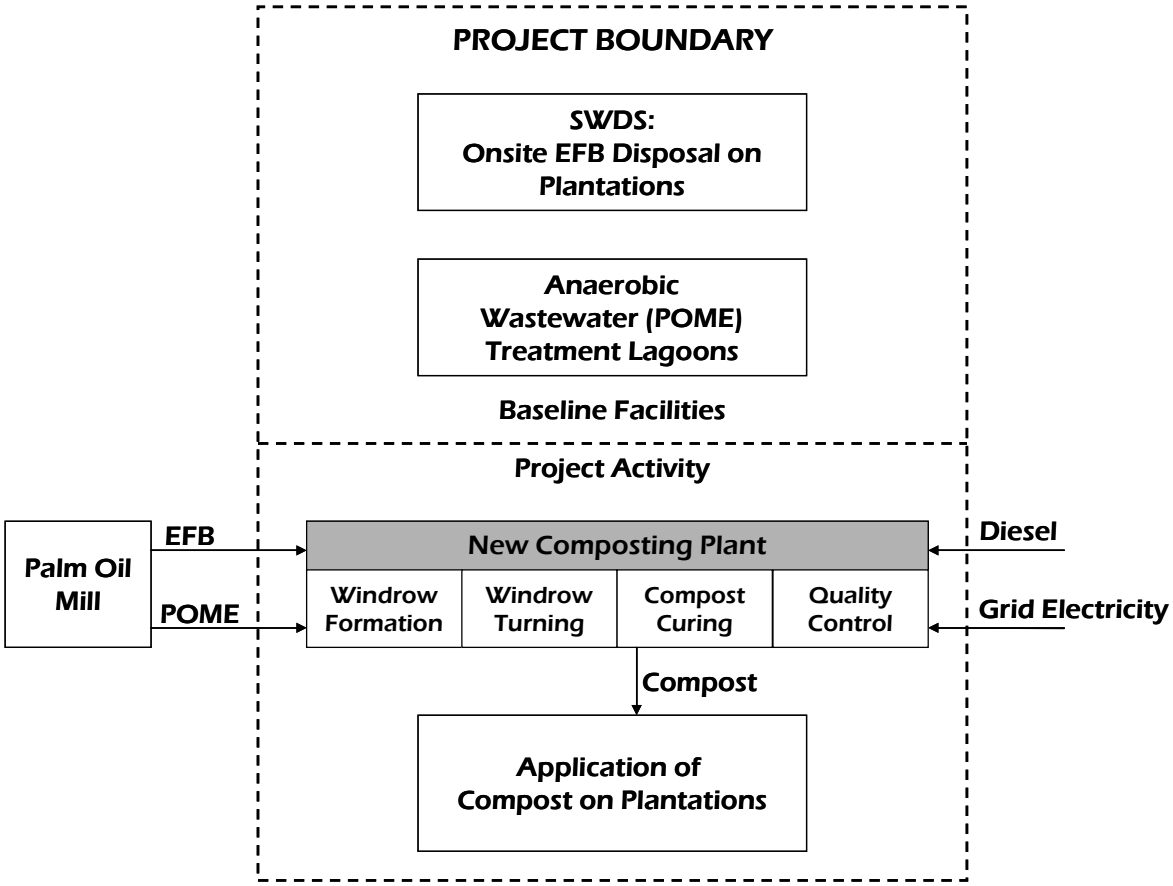
AMS III.F	*Applicability Criteria*	*Project Activity*
Point 10	In case produced compost is handled aerobically and submitted to soil application, the proper conditions and procedures (not resulting in methane emissions) must be ensured.	This project activity includes in situ monitoring of the proper soil application of the compost. Please see section B.7.
Point 11	In case produced compost is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.	This project activity does not involve thermal/mechanical treatment.
Point 12	In case produced compost is stored under anaerobic conditions and/or delivered to a landfill, emissions from the residual organic content shall to be taken into account and calculated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site".	This project activity does not include storage under anaerobic conditions or delivery to a landfill.

B.3. Description of the project boundary:

As per part 14 of AMS III.F v10.0, the project boundary includes the following physical, geographical sites:

Project Boundary Requirement as per AMS III.F	*This Project Activity*
Where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;	EFB has been disposed of historically within the 9,500 hectares of plantation associated with Palmeras' mill.
In the case of projects co-composting wastewater, where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;	Wastewater has been treated historically in Palmeras' anaerobic treatment lagoons.
Where the treatment of biomass through composting or anaerobic digestion takes place;	Composting will take place on Palmeras' agro-industrial facility, adjacent to the wastewater treatment lagoons.
Where the residual waste from biological treatment or products from those treatments, like compost and slurry, are handled, disposed, submitted to soil application, or treated thermally/mechanically;	Compost will be applied within the 9,500 hectares of plantation associated with Palmeras' mill. Compost will not be sold for other uses.
Where biogas is burned/flared or gainfully used;	No biogas in generated in this project activity.
And the itineraries between them (a, b, c, d and e), where the transportation of waste, wastewater, where applicable manure, compost/slurry/products of treatment or biogas occurs.	All of these itineraries are located within the Palmeras' agro-industrial facilities and the 9,500 hectares of plantations associated with the mill.

Therefore, the project boundary is delimited by the 9,500 hectares of plantations, the new composting plant, and the wastewater treatment lagoons:



The sources of emissions within the project boundary and its baseline are described in the following table:

	Source	Gas	Included?	Justification / Explanation
Baseline	Biomass disposed in unmanaged landfills	CO_2	No	CO_2 emissions from biomass decay in landfills is considered GHG neutral.
		CH_4	No	Methane emissions from biomass decay in the landfills are accounted for as zero to be conservative.
		N_2O	No	Not significant. Excluded for simplification and conservativeness.
	Open Lagoons	CO_2	No	CO_2 emissions from biomass source are considered GHG neutral.
		CH_4	Yes	Methane emission from anaerobic process
		N_2O	No	Not significant. Excluded for simplification and conservativeness.
	Transportation	CO_2	No	Methodology AMS III.F considers incremental transport emissions under the project activity, thus they should be ignored in the baseline
		CH_4	No	
		N_2O	No	
	Auxiliary Equipment	CO_2	No	Use of auxiliary equipment in the baseline is ignored, to be conservative.
		CH_4	No	
		N_2O	No	
Project Activity	Composting process	CO_2	No	CO_2 emissions from composting process is considered GHG neutral.
		CH_4	Yes	Methane emissions from anaerobic pockets during composting process.
		N_2O	No	Proper onsite soil application of the compost will prevent these emissions and be monitored.
	Runoff Water	CO_2	No	CO_2 emission from biomass source and considered GHG neutral.
		CH_4	Yes	Methane emission from anaerobic process of runoff water collected after the project activity.
		N_2O	No	Not significant, excluded by AMS III.F
	Additional Transportation due to Project Activity	CO_2	No	Under baseline, current practice, EFB is hauled to the plantation, piled, and then mulched. In the project activity, composting will reduce waste mass by nearly 50%. This weight reduction is attributed to both moisture reduction and decay in the composting process. The itineraries for hauling the compost will be identical as those in the baseline mulching. Since transport distances are identical in the baseline and project scenarios but waste mass is less in the project scenario, transport fuel consumption can be expected to decrease due to the project activity. Thus incremental transport emissions will be negative. To be conservative, these emissions are ignored.
		CH_4	No	
		N_2O	No	
	Auxiliary Equipment	CO_2	Yes	Incremental emissions from grid electricity and fossil fuel
		CH_4	No	Not significant, excluded for simplification

		N_2O	No	Not significant, excluded for simplification

B.4. Description of baseline and its development:

AMS III.F v10.0 defines the baseline as *the situation where, in the absence of the project activity, biomass and other organic matter are left to decay within the project boundary and methane is emitted to the atmosphere.* For this project activity, the baseline scenario is the continuation of current practices based on the following considerations:

A. Current practice for managing EFB
B. Current practice for managing POME
C. Common practices for managing EFB and POME in the Colombian palm oil sector
D. Compliance with legal and regulatory requirements
E. Feasibility

A) EFB from the Palmeras' mill is sometimes crushed at the plant, hauled to the plantation either whole or crushed, and piled on the ground. Once piled, they receive no handling, and decay naturally. Palmeras has pilot-tested composting of some EFB, in order to remove technical risk from this project activity. To be conservative, the baseline emissions for EFB are accounted for as zero.

B) POME from the Palmeras' mill is treated in a series of treatment lagoons. The principal treatment lagoons operate anaerobically and have a design depth of 3 metres. The operating lagoons were constructed in 2004, upgrading the prior onsite wastewater treatment facility.

C) Common practices for managing EFB and POME wastes in Colombia are documented in a recent report commissioned by the industry association[3]. Piling and mulching of EFB as practiced by Palmeras is reported as the most common practice in Colombia. Some 99% of the country's palm oil mills are reported to have wastewater anaerobic treatment systems for their POME.

D) Compliance with applicable laws and regulations at the Palmeras' facility is demonstrated through existing environmental permits and concessions (waste management permit, water discharge permit, approved environmental management plan, groundwater concession, and surface water concession)[4]. The POME treatment system has sufficient capacity to treat present and expected future POME volumes. Current practice of onsite dumping of EFB complies with the license.

E) The mill´s POME treatment system was upgraded in 2004 to fully comply with applicable regulations at present and expected future production capacity. Any alternative treatment scheme would require additional investment, and thus is not considered economically feasible.

[3] CENIPALMA and FEDEPALMA. Prospective Agenda for Research and Development in the Value Chain for Palm Oil. February 2009.

[4] Palmeras' environmental permits are issued by the regional authority (Corpocesar). Waste management permit: Resolution 054, 7 feb 2007; water discharge permit: Resolution 1050, 10 Oct 2006; approved environmental management plan: Resolution 437, 17 Jun 2004; groundwater concession: Resolution 074, 7 Feb 2006; surface water concession: Resolutions 001/2002 and 001/2004 regulate surface water rights in the entire region.

Current practices are shown in the following photos:

Anaerobic wastewater treatment lagoon for POME at the Palmeras' mill

EFB piled on the Palmeras' plantation

The key data and parameters for quantifying this baseline scenario are:

Data/Parameter	Units	Value	Source/Explanation
FFB Processed	t/yr	220,000	Projected 2012 production
EFB	% of FFB	23%	Historic average at the Palmeras mill
Effluent	m^3/tFFB	0.8	Historic average at the Palmeras mill
Effluent BOD	kg/m^3	25.0	Industry handbook value

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Prior Consideration

Version 1 of this PDD was published for global stakeholder comment (26/05/2010) prior to the project start date (section C.1.1). Previously, the project notified the EB and the DNA of its intention to seek CDM status. The DNA issued a letter of no-objection on 26/03/2010. Therefore the project is fully compliant with the guidelines on prior consideration.

The following table shows the key events in the timeline for developing this project activity:

Date	Milestone
24/11/2009	Palmeras' board decision to design and develop the project, considering CDM income as a key element
28/11/2009	Agreement between Palmeras and Aretech to collaborate in developing the project
25/02/2010	Prior Consideration Notification
01/03/2010	Compost plant design report
07/04/2010	Compost plant cost estimate

28/04/2010	Local Stakeholder Consultation
26/05/2010	Global Stakeholder Comment
27/07/2010	Palmeras' board decision to invest in the project
15/10/2010	Letter of Approval, Colombian DNA
18/01/2011	Project Start Date, determined through the purchase order for the Windrow turner (please see section C.1.1)
Nov 2011	Shake-down and start-up of composting operations

Demonstration and Assessment of Additionality

To demonstrate and assess additionality, a barrier analysis is carried out in accordance with the "Guidelines on the Demonstration of Additionality of Small-Scale Project Activities and Programme of Activities" version 09.0. According to the guidelines, project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions
b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;
c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;
d) Other barriers

In this proposed Project, the investment and prevailing practice barriers are analyzed in order to determine additionality.

1. Investment Barrier Analysis

This project activity will have two revenue streams: income from compost sold to plantation owners (that are also Palmeras' shareholders) and CERs. . Therefore, according to the non-binding best practice examples, a simple cost analysis is not indicated, but rather, a benchmark analysis should be carried out. A benchmark analysis is also suggested for this project by the investment analysis guidelines, since the baseline scenario would require no new investment. The following benchmark analysis, based on the NPV of the project cash flows, evaluates the proposed project activity in the absence of CER revenues. NPV is considered an appropriate indicator since Palmeras already has in place sufficient capacity to treat the POME and EFB that it generates. Thus a positive NPV would indicate an attractive investment opportunity for Palmeras, whereas a negative NPV would indicate that Palmeras would not invest in the project and would continue with its current waste and wastewater management practices.

The basis of the investment analysis follows:

Period of Assessment	A 20-year assessment period is used. This coincides with the depreciation period of the civil works as per Colombian regulation[5] Since the windrow turner is expected to have an accounting and technical life of 10 years, a new unit is purchased at the end of year 10. The investment in fixed plant is expected to have a life of some 25 years. Therefore, a residual value is applied to civil works at the end of the assessment period.
Residual Value	Mobile and fixed plant equipment items are expected to have no residual value at the end of the 20 year assessment period. Civil works are assumed to have a residual value equal to 33% of their original cost. This assumption is more conservative than the Colombian regulation that requires depreciation over 20 years and also conservative compared to the estimated technical lifetime of 25 years. The residual value also assumes full recovery of the working capital investment at the end of the period of assessment.
Non-cash items	Non-cash items are excluded from the cash-flow analysis to determine NPV. Tax is included in the analysis and the basis for the discount rate.
Input values	All input values are clearly identified and referenced in the table below and in the attached spreadsheet.
Spreadsheet	For transparency, a spreadsheet of the investment analysis is attached.
Financing expenditures	Financing expenditures are excluded from the NPV calculation.
Discount rate	A sectoral discount rate based on return on total, restated assets has been derived from official data published by the Colombian Superintendant for Corporations[6]. This discount rate has the same basis (after tax operational cash flow, before financing expenditures) as the cash flow analysis to determine the NPV. It was derived for the food products sector (8.00% average over 2007-2009) as well as the edible oil subsector (8.05%). The lower (more conservative) value is applied. Palmeras considers itself to be the only potential developer of this project, since the plantation owners hold a majority of its shares, and is thus a vertically integrated agricultural and industrial operation.
Sensitivity analysis	Sensitivity analyses are carried out for investment costs (±10%), operating costs (±10%), and the discount rate (±10%). Additionally, a breakeven analysis is carried out in order to identify under what input conditions variations in the result would occur (i.e. the NPV becomes positive).

The key input values are summarized below:

[5] Article 2 of Decree 3019 of 1989

[6] The SIREM database published by this agency (www.supersociedades.gov.co) provides sectoral balance sheets and income statements. This database was accessed to calculate average operational Return on Assets (including depreciation, before taxes and financing charges) for both the food processing sector and the edible oil subsector, being relevant and reliable benchmarks for carrying out the NPV analysis.

The investment costs associated with this project activity include:

- Site preparation and impermeabilization
- Co-composting plant roofing
- Windrow compost pile turners
- POME spray system
- Runoff water management system

The total investment cost, according to the turn-key vender quotation considered by Palmeras' board of directors, is approximately 2.947 billion Colombian Pesos.

The principal direct operating costs associated with this project activity include:

- Labour to operate the compost plant and equipment
- Maintenance of Windrow turners and other systems
- Energy consumption (diesel and electric power)

The operating costs are estimated to be 734 million Colombian Pesos annually.

Palmeras' board of directors has approved the formula for the pricing of compost. All compost will be used by Palmeras on its own plantations (internal transfer pricing) or on shareholders' plantations. The pricing formula is fully reflexive of the compost's total costs, applying national accounting regulations. Revenue from compost sales (or internal transfers) is estimated to be 661 million pesos annually.

The operating costs that would be forgone to operate the compost plant are also included. These forgone costs are the variable cost savings from not operating the POME anaerobic treatment lagoons. These variable costs have been identified from historical accounting records to average some 35 million pesos annually.

These and all other input values (tax rates, exchange rates, etc.) are clearly indicated and referenced in the attached investment analysis spreadsheet and summarized in the following table:

Concept		Value	Source
Initial Investment, thousand COP			
	Civil Works	1,524,570	Engineering Design Study and Additional Project Design Information Supplied by Bioprocesos, S.A.
	Plant and Equipment	1,024,284	
	Engineering and Supervision	250,000	
	Working Capital	148,161	
	Subtotal	2,947,015	
Annual O&M costs, thousand COP		734,367	
Depreciation Periods, years			
	Civil Works	20	Article 2 of Decree 3019 of 1989
	Plant and Equipment	10	
	Engineering and Supervision	10	
Compost Selling Price (COP/t)		18,139	Application of the compost pricing formula ratified by Palmeras' board of

		directors on 25 August 2010 in accordance with the investment decision of 27 July 2010. Average exchange rate 2,061COP = 1USD for period 2008-2009 published by Colombian Central Bank (most recent two-year dataset available at investment decision) Compost revenues consider 36,465 t/y estimated compost production (Bioprocesos design study)
Foregone Annual WWTP Costs, thousand COP	34,510	Average WWTP costs for 2007-2009 derived from Palmeras' accounting records
Corporate Income Tax Rate	33%	Article 12 of Law 1111 of 2006
Discount Rate	8.0%	After tax, before financing sectoral return on assets (Colombian Superintendent for Corporations, cited above)

The result of the cash flow analysis is a negative NPV of 2.9 billion pesos for the project scenario. The baseline scenario has higher emissions and is financially more attractive. Therefore, the investment barrier is demonstrated.

Sensitivity Analysis

The sensitivity analysis demonstrates that this conclusion is robust. The attached spreadsheet includes sensitivity analysis for all key variables - investment cost (±10%), operation and maintenance cost (±10%), and discount rate (±10%) - as shown in the following table:

Sensitivity Analysis Case	**NPV (thousand COP)**
Base Case	-2,907,781
+10% Investment	-3,039,330
-10% Investment	-2,776,233
+10% O & M Cost	-2,907,781
-10% O & M Cost	-2,907,781
+10% Discount Rate	-2,908,636
-10% Discount Rate	-2,905,683

In all cases, the NPV of the project is negative and less than -2 billion pesos.

It is noted that variations in the operation and maintenance costs do not affect the NPV. This is attributed to the compost pricing formula adopted by the Board of Palmeras on 25 August 2010, which passes through these costs into the compost price. Since the compost price is determined by formula, not being a fixed value, it cannot be subject to a sensitivity analysis.

Breakeven Analysis

The attached financial analysis spreadsheet shows 3 exploratory cases searching for the breakeven points, i.e. at what value of key input parameters would the NPV become positive. Such breakeven points have not been identified:

- At zero investment cost, the NPV is still negative.
- At zero operation and maintenance cost, the NPV is still negative.
- At zero discount rate, the NPV is still negative.

The breakeven analysis thus concludes that no reasonable deviations from the stated input parameters would cause a variation in the net result (a negative NPV).

Demonstration of Investment Barrier

Guideline 6 of the "Guidelines for Objective Demonstration and Assessment of Barriers" states;

> In case the PPs make the claim for investment barriers, they should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM.

The financing of this Project is carried out entirely by Palmeras. While the Project was in the planning stage, Palmeras' board of directors agreed to seek the benefit of the CDM for this Project. Several months later the board authorized the investment in the Project. Since the project is financed on balance sheet by Palmeras, these board meetings demonstrate how the financing of the project was assured by CDM benefits.

As a result of the investment barrier analysis, the Project is considered additional.

2. Prevailing Practice Barrier Analysis

As per the non-binding best practice examples, following is a listing of the evidence known to the project participants that the proposed project activity is ***among*** the first of its kind.

- The recent technical reference cited in section B.4[7] indicates that 99% of the palm oil mills in Colombia treat POME in anaerobic lagoons and that mulching is prevailing practice for managing EFB.
- Many of Colombia's palm oil mills are included in registered CDM project 1942[8]. All of the mills listed in this project treat POME in anaerobic lagoons, thus none of them co-compost POME with EFB.
- Only three other palm oil mills in Colombia have published a PDD for global stakeholder review[9] to co-compost POME and EFB, two of which were after the GSC of this project.

[7] Idem, 2009, FEDPALMA and CENIPALMA

[8] FEDEPALMA Sectoral CDM Umbrella Project

[9] INDUPALMA Palm Oil Mill Waste Recycle Project, published on 30 Sep 2009; Co-composting of organic residues in ORO ROJO's Palm Oil Mill at Sabana de Torres, Colombia, published on 14 April 2011; Loma Fresca Methane Avoidance and Co-Composting Projectm published on 22 June 2011

- Consultations with two leading composting equipment suppliers[10] indicated that palm oil mills are not composting in Colombia.

The non-binding best practice for small-scale CDM project activities indicates that the prevailing practice barrier is satisfied when a project is "among" the first of its kind. The above evidence (documental and testimonial) supports that this project activity might not be the very first but is certainly one of the first of its kind in Colombia. As a result of the analysis of the prevailing practice barrier, the additionality of this Project is supported.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

According to part 14 of methodology AMS III.F v10.0, baseline emissions are to be calculated as follows:

$$BE_y = BE_{CH4,SWDS,y} + BE_{ww,y} + BE_{CH4,manure,y} - MD_{y,reg} * GWP\_CH_4$$

(Equation 1)

Where:

BE_y	Baseline emissions associated with the project activity in the year y (tCO_2e)
$BE_{CH4,SWDS,y}$	Yearly methane generation potential of the solid waste composted by the project activity during the years "x" from the beginning of the project activity (x=1) up to the year *y* (tCO_2e)
$BE_{ww,y}$	Where applicable, baseline emissions from the wastewater co-composted, calculated as per the procedures in AMS III.H (tonne)
$BE_{CH4,manure,y}$	Where applicable, baseline emissions from manure composted by the project activities, as per the procedures of AMS-III.D
$MD_{y,reg}$	Amount of methane that would have to be captured and combusted in the year *y* to comply with the prevailing regulations (tonne)
GWP_CH_4	*GWP* for CH_4

The term $BE_{CH4,manure,y}$ does not apply, since manure is not composted in this project activity. To be conservative, the term $BE_{CH4,SWDS,y}$ is accounted for as zero.

Part 14 of methodology AMS III.F v10.0 requires that the term $BE_{ww,y}$ be calculated as per methodology AMS III.H. Part 20 of methodology AMS III.H v16.0 stipulates that the term $BE_{ww,treatment,y}$ be calculated as follows:

$$BE_{ww,treatment,y} = \sum_i (Q_{ww,i,y} * COD_{inf\ low,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

[10] Bioprocesos, S.A. and AV Composting Ltda.

Where:

$Q_{ww,y}$	Volume of wastewater entering the co-composting facility in the year y (m^3)
$COD_{\text{inf } low,y}$	Chemical oxygen demand of the wastewater entering the co-composting facility in the year y (tonnes/m^3)
$\eta_{COD,y}$	COD removal efficiency of the baseline WWTS
$MCF_{ww,treatment,BL}$	Methane correction factor for the wastewater treatment system in the baseline scenario
$B_{o,ww}$	Methane producing capacity for the wastewater (kg CH_4/kg BOD)
UF_{BL}	Model correction factor to account for model uncertainties for wastewater

The application of this formula is subject to the following observations:

- The subscripts of the variable BE are adjusted to be consistent with methodology AMS III.F v10.0
- Only one wastewater stream is used in this project activity, hence the summation sign and index *i* can be ignored.
- AMS III.H v16.0 allows either BOD or COD to be used to determine the organic content of the wastewater. This Project's Participants have selected the BOD option.[11]

The formula is thus revised to reflect the above observations:

$$BE_{ww,y} = Q_{ww,y} * BOD_{\text{inf } low,y} * \eta_{BOD,y} * MCF_{ww,treatment} * B_{o,ww} * UF_{BL} * GWP_{CH4}$$

(Equation 2)

Where:

$BOD_{\text{inf } low,y}$	Biological oxygen demand of the wastewater entering the co-composting facility in the year y (tonnes/m^3)
$\eta_{BOD,y}$	BOD removal efficiency of the baseline WWTS
$MCF_{ww,treatment}$	Methane correction factor for the wastewater treatment system in the baseline scenario

According to part 15 of methodology AMS III.F v10.0, project emissions are to be calculated as follows:

$$PE_y = PE_{y,transp} + PE_{y,power} + PE_{y,comp} + PE_{y,runoff} + PE_{y,res\ waste}$$

(Equation 3)

Where:

PE_y	Project activity emissions in the year y (tCO_2e)

[11] BOD is the preferred option of most international organizations such as the UN and the EU for water quality as evidenced in the 2005 UNEP GEMS Workshop Report on Development and Use of Global Water Quality Indicators and Indices. BOD will be monitored directly by this project activity, not estimated based on COD measurements.

$PE_{y,transp}$	Emissions from incremental transportation in the year *y* (tCO_2e)
$PE_{y,power}$	Emissions from electricity or fossil fuel consumption in the year *y* (tCO_2e)
$PE_{y,comp}$	Methane emissions during composting process in the year *y* (tCO_2e)
$PE_{y,runoff}$	Methane emissions from runoff water in the year *y* (tCO_2e)
$PE_{y,res\ waste}$	In case produced compost is subject to anaerobic storage or disposed in a landfill: methane emissions from the anaerobic decay of the residual organic content (tCO_2e)

As described in section B.3, the project activity does not involve incremental transport or storage under anaerobic conditions. Therefore the terms $PE_{y,transp}$ and $PE_{y,res\ waste}$ do not apply.

The definition of the term $PE_{y,power}$ embraces both electric power and fossil fuel consumption from project equipment items. It is calculated as follows:

Project Electricity Consumption

This project uses the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" v01, as specified in part 27 of AMS III.F v10.0. Project emissions from electricity consumption are thus defined by the following formula:

$$PE_{EC,y} = EC_y * EF_{CO2,ELEC,y} * (1 + TDL_y)$$

For the emission factor, this project uses option A2 from the tool, a conservative default value of 1.3 tCO_2/MWh. For the system losses, this project uses the conservative default value of 20% as per the tool. These parameters are thus fixed for the crediting period and do not need to be monitored.

Project Fossil Fuel Consumption

The only fossil fuel to be consumed in this project is diesel fuel for the windrow turner and other mobile project equipment items. Part 27 of AMS III.F v10.0 refers to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" v2. This tool requires the following formula to calculate fossil fuel emissions:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} * COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/yr)
$FC_{i,j,y}$	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass of volume unit/yr)
$COEF_{i,y}$	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
i	Are the fuel types combusted in process *j* during the year *y*
j	Are the different processes involved in the project activity

This project has only one process: composting. The index *j* can thus be ignored. This project consumes just one fossil fuel type: diesel. The index *i* and the summation over fuel types *i* can thus be ignored. The "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" v2 provides two options to calculate the parameter COEF. This project selects option B (based on net calorific value and fuel-specific emission factor), since the data to use option A (carbon content of fuel) is not readily available. Option B requires that the parameter COEF be calculated as follows:

$$COEF_{Diesel} = NCV_{Diesel} * EF_{CO2,Diesel}$$

Where:

NCV_{Diesel}	Net calorific value for diesel fuel (GJ/mass or volume unit)
$EF_{CO2,Diesel}$	CO_2 emission factor for diesel fuel (tCO_2e/GJ)

For the fuel consumption, this project will measure diesel fuel volumetrically, as indicated by the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" v2. Volumetric measurement is international common practice for on- and off-road vehicle fuel filling.

Project emissions from diesel consumption are thus defined by the following formula:

$$PE_{FC,y} = FC_{Diesel,y} * NCV_{Diesel} * EF_{Diesel}$$

The term $PE_{y,power}$ is therefore calculated according to the following formula:

$$PE_{y,power} = EC_y * EF_{CO2,ELEC} * (1 + TDL) + FC_{Diesel,y} * NCV_{Diesel} * EF_{CO2,Diesel}$$

(Equation 4)

Where:

EC_y	Electricity consumption from Project equipment items in the year y (MWh)
$EF_{CO2,ELEC}$	CO_2 emission factor for electricity (tCO_2e/MWh)
TDL	Transmission and distribution losses
$FC_{Diesel,y}$	Consumption of diesel fuel in the year y (kl)
NCV_{Diesel}	Net calorific value for diesel fuel (GJ/kl)
$EF_{CO2,Diesel}$	CO_2 emission factor for diesel fuel (tCO_2e/GJ)

According to part 18 of methodology AMS III.F v10.0, the term $PE_{y,comp}$ is to be calculated as follows:

$$PE_{y,comp} = Q_y * EF_{composting} * GWP\_CH_4$$

Furthermore, the methodology offers the following option:

$EF_{composting}$ can be set to zero for the portions of Q_y for which the monitored oxygen content of the composting process is above 8%

This project selects to use this option. Therefore, $EF_{composting}$ has a non-zero value only for the portion of the compost that is generated anaerobically – with a monitored oxygen content below 8%. As per the methodology, this will be monitored via sampling with maximum margin of error of 10% at a 90% confidence level. The above equation is thus clarified to reflect this option as follows[12]:

$$PE_{y,comp} = Q_{y,Portion} * EF_{composting} * GWP\_CH_4$$

(Equation 5)

Where:

$Q_{y,Portion}$	The portion of the total weight of wastes to be composted in year y on a wet basis (tonne), that is produced with a monitored oxygen content below 8%.
$EF_{composting}$	Emission factor for composting of organic waste and/or manure (t CH_4/ton waste treated)

According to part 19 of methodology AMS III.F v10.0, the term $PE_{y,runoff}$ is to be calculated as follows:

$$PE_{y,runoff} = Q_{y,ww,runoff} * COD_{y,ww,runoff} * B_{o,ww,runoff} * MCF_{ww,runoff} * UF_{b,runoff} * GWP\_CH_4$$

(Equation 6)

Where:

$Q_{y,ww,runoff}$	Volume of runoff water in the year *y* (m^3)
$COD_{y,ww,runoff}$	Chemical oxygen demand of the runoff water leaving the composting facility in the year *y* (tonnes/m^3)
$B_{o,ww,runoff}$	Methane producing capacity of the wastewater (kg CH_4/kgCOD)
$MCF_{ww,runoff}$	Methane correction factor for the wastewater treatment system where the runoff water is treated
$UF_{b,runoff}$	Model correction factor to account for model uncertainties for runoff

Note: additional subscripts have been introduced to avoid confusion between variables introduced from AMS III.H v16.0 in equation 3.

Leakage

The project technology does not include any equipment transferred from another activity nor will any existing equipment is transferred to another activity. Therefore, as per paragraph 21 of AMS III.F v10.0, leakage does not apply.

Competing uses for the biomass

[12] An additional subscript has been introduced for Q_y to provide clarity.

The sources cited in Section B.5 clearly demonstrate:

- No EFB is used in Colombia for co-products or as an energy source
- All EFB generated in Colombia is disposed of in SWDS or piled on the plantations and, after decomposing, mulched.

Therefore, competing uses for EFB do not exist in Colombia. Furthermore, since the EFB would have been left to decay, clarification SSC_236 establishes that competing uses are absent and need not be assessed.

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

(Copy this table for each data and parameter)

Data / Parameter:	$\eta_{BOD,BL}$
Data unit:	-
Description:	COD/BOD removal efficiency of the baseline treatment system
Source of data used:	Historical records as per AMS III.H version 16.0 part 26
Value applied:	0.939
Justification of the choice of data or description of measurement methods and procedures actually applied :	Part 26 of AMS III.H v16.0 requires historical records of at least 1 year prior to project implementation. This condition is satisfied by Palmeras' wastewater treatment system and data registers. Vintage 2009 was selected since it was the most recent year of data available at the time of deciding to implement the project.
Any comment:	The subscripts for this variable have been modified for clarity.

Data / Parameter:	$MCF_{ww,treatment}$
Data unit:	-
Description:	Methane correction factor for the wastewater treatment system in the baseline scenario
Source of data used:	AMS III.H version 16.0 Table III.H.1
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Palmeras' two anaerobic lagoons have a depth of 3 meters. This default value applies to anaerobic lagoons with a depth over 2 meters.
Any comment:	

Data / Parameter:	$B_{o,ww}$
Data unit:	kg CH_4/kg BOD
Description:	Methane producing capacity for the wastewater
Source of data used:	AMS III.H version 16.0
Value applied:	0.60
Justification of the choice of data or	Default value in methodology, based on the IPCC default value. This project activity has chosen to measure BOD directly, not COD, as per the option

description of measurement methods and procedures actually applied :	provided in part 20 of the methodology.
Any comment:	

Data / Parameter:	**UF_{BL}**
Data unit:	-
Description:	Model correction factor to account for model uncertainties for wastewater
Source of data used:	AMS III.H version 16.0
Value applied:	0.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value in methodology
Any comment:	

Data / Parameter:	**$EF_{CO2, Elec}$**
Data unit:	tCO_2e/MWh
Description:	Emission factor for electricity consumed
Source of data used:	Tool to calculate baseline, project and/or leakage from electricity consumption, version 01
Value applied:	1.3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value as per tool
Any comment:	

Data / Parameter:	**$EF_{composting}$**
Data unit:	T CH_4/ton waste treated
Description:	Emission factor for composting of organic waste and/or manure
Source of data used:	AMS III.F version 10.0
Value applied:	0.004
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values. wet weight basis
Any comment:	Waste quantities and waste characteristics will be measured and reported on a wet basis

Data / Parameter:	$B_{o,ww,runoff}$
Data unit:	kg CH_4/kg COD
Description:	Methane producing capacity of the wastewater
Source of data used:	AMS III.F version 10.0
Value applied:	0.25
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value in methodology, based on the IPCC default value.
Any comment:	

Data / Parameter:	$MCF_{ww,runoff}$
Data unit:	-
Description:	Methane correction factor for the wastewater treatment system where the runoff water is treated
Source of data used:	AMS III.H version 16.0 Table III.H.1
Value applied:	0.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Runoff water, if not recycled, will be treated in lagoons that will no longer be in use. Depth will be maintained less than 2 meters. This value applies to anaerobic shallow lagoons (depth less than 2 meters)
Any comment:	The subscripts for this variable have been modified for clarity.

Data / Parameter:	$UF_{b,runoff}$
Data unit:	-
Description:	Model correction factor to account for model uncertainties for runoff
Source of data used:	AMS III.F version 10.0
Value applied:	1.12
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value in methodology.
Any comment:	The subscripts for this variable have been modified for clarity.

B.6.3 Ex-ante calculation of emission reductions:

The ex-ante calculation of emission reductions is carried out in the attached spreadsheet. This section describes all equations and parameters used in the ex-ante calculation.

Ex-ante Calculation of Baseline Emissions

Baseline emissions for the methane generation potential of wastewater (POME) are calculated from equation 2 using the following parameters:

Parameter	*Data Unit*	*Value*	*Source/Explanation*
$Q_{ww,y}$	m^3	176,000	Estimated POME production 2012
$BOD_{inflow,y}$	tonnes/m^3	0.025	Handbook value (please see section B.7.1)
$\eta_{BOD,BL,y}$		0.939	Fixed value (please see section B.6.2)
$MCF_{ww,treatment}$	- -	0.8	Fixed value (please see section B.6.2)
$B_{o,ww}$	kg CH_4/kg BOD	0.60	AMS III.H v16 default value.
$MCF_{ww,treatment}$	- -	0.8	Fixed value (please see section B.6.2)
UF_{BL}	- -	0.89	Fixed value (please see section B.6.2)

The result of introducing these parameters into equation 2 for year one is:

$$BE_{ww,treatment,1} = 37{,}065 \text{ ton } CO_2e$$

Equation 1 is simplified to reflect that no methane capture from the anaerobic treatment lagoons or the SWDS is required under prevailing regulations, that manure is not included in this project activity, and that solid waste decay baseline emissions are conservatively accounted for as zero:

$$BE_y = BE_{ww,treatment,i}$$

Baseline emissions for year 1 are thus calculated to be:

$$BE_1 = 37{,}065 \text{ ton } CO_2e$$

Ex-ante Calculation of Project Emissions

Project emissions from incremental fuel use and power consumption are calculated from equation 4 using the following parameters:

Parameter	*Data Unit*	*Value*	*Source/Explanation*
EC_y	MWh	96.0	Estimated project power consumption
$FC_{Diesel,\ y}$	kl	176,7	Estimated project diesel consumption
NCV_{Diesel}	GJ/kl	36.359	Default value (please see section B.7.1)
$EF_{CO2,Diesel}$	tCO_2e/GJ	0.0748	Default value (please see section B.7.1)
$EF_{CO2,Elec}$	tCO_2e/MWh	1.3	Fixed value (please see section B.6.2)
TDL_y	- -	0.20	Default value (please see section B.7.1)

The result of introducing these parameters into equation 4 is:

$$PE_{1,power} = 630 \text{ ton } CO_2e$$

Project emissions from composting activities are calculated from equation 5 using the following parameters:

Parameter	*Data Unit*	*Value*	*Source/Explanation*

$EF_{composting}$	tCH_4/t waste treated	0.004	Fixed value (please see section B.6.2)
GWP_CH_4		21	AMS III.F v10.0 default value
$Q_{y,Portion}$	t	10,120	20% of estimated EFB production 2012

The result of introducing these parameters into equation 5 is:

$PE_{1,comp}$ = 850 ton CO_2e

Project emissions from runoff are calculated from equation 6 using the following parameters:

Parameter	***Data Unit***	***Value***	***Source/Explanation***
$Q_{y,ww,runoff}$	m^3	24,000	Estimated based on annual rainfall
$COD_{y,ww,runoff}$	tonnes/m^3	0.001	Handbook value for domestic wastewater
$B_{o,ww,runoff}$	kg CH_4/kg COD	0.25	Fixed value (please see section B.6.2)
$MCF_{ww,runoff}$	- -	0.20	Fixed value (please see section B.6.2)
$UF_{b,runoff}$	- -	1.12	Fixed value (please see section B.6.2)
GWP_CH_4		21	AMS III.F v10.0 default value

The result of introducing these parameters into equation 6 is:

$PE_{1,runoff}$ = 28 ton CO_2e

Equation 3 is simplified to reflect that no incremental emissions occur due to waste transport, leakage or anaerobic decomposition of residual waste:

$$PE_y = PE_{y,power} + PE_{y,comp} + PE_{y,runoff}$$

Project emissions for year 1 are thus calculated to be:

PE_1 = 1,509 ton CO_2e

Since leakage emissions can be ignored for this project activity, the emission reductions for year 1 are estimated by subtracting the project emissions from the baseline emissions:

ER_1 = 35,557 ton CO_2e

Emission reductions are projected to be constant during the crediting period, thus the year 1 values shown above also apply to the other years of the period, as well as the average value.

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

Year	**Estimation of project activity emissions (tCO_2 e)**	**Estimation of baseline emissions (tCO_2 e)**	**Estimation of leakage (tCO_2 e)**	**Estimation of overall emission reductions (tCO_2 e)**
2013*	1,509	37,065	0	35,557
2014	1,509	37,065	0	35,557

2015	1,509	37,065	0	35,557
2016	1,509	37,065	0	35,557
2017	1,509	37,065	0	35,557
2018	1,509	37,065	0	35,557
2019	1,509	37,065	0	35,557
Total (Tonnes of CO_2 e)	**10,560**	**259,458**	**0**	**248,897**

*Crediting period years as expected to start on 1 January and end on 31 December, as per section C.2.1.1

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$MD_{y,reg}$**
Data unit:	tons
Description:	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations
Source of data to be used:	Compilation of environmental laws and regulations published on the web page of the environmental ministry
Value of data	0 (at validation)
Description of measurement methods and procedures to be applied:	Literature review of promulgated regulations
QA/QC procedures to be applied:	Informal consultation with regional authority (Corpocesar) to confirm regulatory analysis
Any comment:	

Data / Parameter:	**GWP_CH_4 / GWP_{CH4}**
Data unit:	
Description:	GWP for CH_4
Source of data to be used:	UNFCCC
Value of data	21 (at validation)
Description of measurement methods and procedures to be applied:	Literature review for CDM requirements
QA/QC procedures to be applied:	N/A
Any comment:	As per the "Standard for application of the global warming potential to Clean Development Mechanism project activities and programmes of activities for the second commitment period of the Kyoto Protocol" version 01.0, this value will be updated effective 01/01/2013 to be in accordance with decision 4/CMP.7.

Data / Parameter:	Q_v	
Data unit:	Tons	
Description:	Amount of organic waste type *j* prevented form disposal in the SWDS in the year *x (EFB)*	
Source of data to be used:	Onsite weigh scale	
Value of data	50,600 (estimated annual value at validation)	
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Each lot
	Equipment	Vehicle weigh scale
	Calibration	Onsite calibration and certification annually
	Accuracy	±1% of full scale
	Responsibility	Plant operators
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001) EFB weight will be cross-checked with Fresh Fruit Bunch (FFB) within the plant's data management system.	
Any comment:		

Data / Parameter:	$Q_{ww,y}$	
Data unit:	m^3	
Description:	Volume of wastewater entering the co-composting facility in the year *y (POME)*	
Source of data to be used:	Onsite flow meter	
Value of data	176,000 (estimated at validation)	
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous monitoring; monthly recordings
	Equipment	Flow meter with totalizer
	Calibration	Offsite calibration every three years
	Accuracy	±4%
	Responsibility	Environmental coordinator
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001) POME volume will be cross-checked with Fresh Fruit Bunch (FFB) within the plant's data management system.	
Any comment:		

Data / Parameter:	$BOD_{inflow,y}$
Data unit:	tonnes/m^3
Description:	Biological oxygen demand of the wastewater entering the co-composting facility in the year *y*
Source of data to be	Offsite laboratory

used:		
Value of data	0.025 (estimated at validation based on handbook values[13])	
Description of measurement methods and procedures to be applied:	Method	Grab sampling and laboratory analysis
	Frequency	Minimum 30 samples as per the sampling plan, Annex A4.3
	Equipment	External laboratory accredited nationally for environmental control
	Calibration	As per laboratory protocol for BOD measurement
	Accuracy	±10% precision at 90% confidence level as per the sampling plan, Annex A4.3
	Responsibility	Environmental coordinator
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001)	
Any comment:	Sampling plan according to the "Standard for sampling and surveys for CDM project activities and programme of activities" v03.0 is included in Annex A4.3. This project activity has selected the BOD option instead of COD measurement. Variable names and subscripts have been modified for clarity to reflect this methodological choice.	

Data / Parameter:	**EC_y**	
Data unit:	MWh	
Description:	Electricity consumption from project equipment items in the year y	
Source of data to be used:	Onsite power meter	
Value of data	96.0 (estimated at validation)	
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous monitoring; monthly recordings
	Equipment	Power meter with totalizer
	Calibration	Offsite calibration every three years
	Accuracy	±2%
	Responsibility	Environmental coordinator
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001)	
Any comment:		

Data / Parameter:	**TDL**
Data unit:	- -
Description:	Average technical transmission and distribution losses for the power grid
Source of data used:	Tool to calculate baseline, project and/or leakage from electricity consumption, version 01
Value applied:	0.2
Description of measurement methods and procedures to be	Review of CDM tool, in case default value is updated

[13] M. Wambeck, "Handbook for Palm Oil Mills", translated version distributed by FEDEPALMA.

applied:	
QA/QC procedures to be applied:	
Any comment:	Default value as per tool

Data / Parameter:	$FC_{Diesel,y}$	
Data unit:	l	
Description:	Consumption of diesel fuel from project equipment in the year y	
Source of data to be used:	Onsite fuel pump	
Value of data	176,700 (estimated at validation)	
Description of measurement methods and procedures to be applied:	Method	Direct measurement of fuelling of project activity equipment
	Frequency	Each fuelling event
	Equipment	Onsite fuel pump
	Calibration	Annually
	Accuracy	±4%
	Responsibility	Plant operators
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001) All onsite diesel consumption is measured and assigned to operational cost centres. This data can be cross-checked through accounting records.	
Any comment:		

Data / Parameter:	NCV_{Diesel}
Data unit:	GJ/kl
Description:	Net calorific value of diesel fuel in volumetric units
Source of data to be used:	IPCC Guidelines (version 2006 at validation)
Value of data:	36.359 (at validation)
Description of measurement methods and procedures to be applied:	Review of IPCC guidelines
QA/QC procedures to be applied:	N/A
Any comment:	Data source d) for this parameter is chosen since NCVs are not reported on purchasing records of commercial liquid fuels; only volumes are reported. The IPCC value of 43.3 GJ/t (95% confidence level upper value, table 1.2, Volume 2, 2006 Guidelines) is converted to volumetric units as required by the applicable tool (am-tool-03-v2) using 0.8397 kg/l (Reece, Mieke. Densities of Oil Products. IEA, Paris. Nov 2004), published by the International Energy Agency and thus well-documented and reliable as per data source c) for density within the referenced tool.

Data / Parameter:	$EF_{CO2,Diesel}$
Data unit:	tCO_2/GJ

Description:	Emission factor for diesel fuel
Source of data to be used:	IPCC Guidelines (version 2006 at validation)
Value of data:	0.0748 (at validation)
Description of measurement methods and procedures to be applied:	Review of IPCC Guidelines
QA/QC procedures to be applied:	N/A
Any comment:	Data source d) for this parameter is chosen since EFs are not reported on purchases of commercial liquid fuels, only volumes. The IPCC value at validation is 0.0748 tCO_2/GJ (95% confidence level upper value, table 1.4, Volume 2, 2006 Guidelines).

Data / Parameter:	$Q_{y,Portion}$	
Data unit:	t	
Description:	Portion of waste material that is composted in the presence of less than 8% oxygen	
Source of data to be used:	Continuous measurement of waste material (please see variable Q) Onsite oxygen sampling and analysis	
Value of data	10,120 (conservative estimate at validation, assuming that 20% of compost is produced in the presence of less than 8% oxygen)	
Description of measurement methods and procedures to be applied:	Method	Spot sampling of oxygen content in compost piles and statistical determination as per the "Standard for sampling and surveys for CDM project activities and programme of activities" v03.0.
	Frequency	Minimum 271 samples as per sampling plan, Annex A4.2
	Equipment	Portable oxygen meter with a 1m lance
	Calibration	Self-calibrating oxygen probe (zero and full-scale)
	Accuracy	±10% precision at 90% confidence level as per the sampling plan, Annex A4.2
	Responsibility	Plant operators
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001)	
Any comment:	Sampling plan according to the "Standard for sampling and surveys for CDM project activities and programme of activities" v03.0 is included in Annex A4.2 This variable is determined by multiplying the total volume of waste to be composted (Q) by the fraction produced in the presence of less than 8% oxygen.	

Data / Parameter:	$Q_{y,ww,runoff}$
Data unit:	m^3
Description:	Volume of runoff water in the year *y*
Source of data to be used:	Onsite flow meter
Value of data	24,000 (estimated at validation based on annual rainfall)

Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous monitoring; monthly recordings
	Equipment	Flow meter with totalizer
	Calibration	Offsite calibration every three years
	Accuracy	±4%
	Responsibility	Environmental Coordinator
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001)	
Any comment:		

Data / Parameter:	**$COD_{y,ww,runoff}$**	
Data unit:	tonnes/m^3	
Description:	Chemical oxygen demand of the runoff water leaving the composting facility in the year *y*	
Source of data to be used:	Offsite laboratory	
Value of data	0.001 (estimated at validation based on handbook values[14])	
Description of measurement methods and procedures to be applied:	Method	Grab sampling and laboratory analysis
	Frequency	Minimum 30 samples as per the sampling plan, Annex A4.3
	Equipment	External laboratory accredited nationally for environmental control and certified to the standard ISO 17025
	Calibration	As per laboratory protocol for COD measurement
	Accuracy	±10% precision at 90% confidence level as per the sampling plan, Annex A4.3
	Responsibility	Environmental coordinator
QA/QC procedures to be applied:	Measurement to be included within the plant's integrated management system (certified to ISO 9001)	
Any comment:	Sampling plan according to the "Standard for sampling and surveys for CDM project activities and programme of activities" v03.0 is included in Annex A4.3.	

Data / Parameter:	**Compost Quality Control Program**
Data unit:	- -
Description:	The operation of the co-composting facilities will be documented in a quality control program, monitoring the conditions and establishing the procedures that ensure the aerobic condition of the waste during the composting process (pile geometry, turning frequency, oxygen, moisture, temperature, etc.).
Source of data to be used:	Record keeping of onsite measurements as per the quality management system.
Value of data	- -
Description of measurement methods and procedures to be applied:	The compost quality control program will be included within the scope of Palmeras' quality management system, certified to the ISO 9001 standard. These technical specifications are subject to modification, based on the commitment to continuous improvement under the ISO 9001 standard.

[14] Davis, MacKenzie L. Waster and Wastewater Engineering: Design Principles and Practice. McGraw Hill. 2010

QA/QC procedures to be applied:	Incorporated within the quality management system.
Any comment:	The initial technical specifications for this system are included in Annex A4.4.

Data / Parameter:	**Adequate Soil Application of Compost**
Data unit:	- -
Description:	Soil application of the compost will be monitored
Source of data to be used:	Delivery records and onsite inspection
Value of data	- -
Description of measurement methods and procedures to be applied:	Dispatch of compost will be measured on the mill's truck scale (please see variable Q for the precision and calibration of this instrument). All lots will be weighed (sampling not applicable) The compost will be applied to plantations in thin layers to assure aerobic decomposition. Photographic evidence will be collected annually to document the adequate soil application of compost. Photographic evidence will be collected on Palmeras' own plantations as well as all private plantations that are dispatched over 500 tons of compost annually. Since all significant plantations will be observed, the requirement of part 25 of AMS III.F v10.0 for monitoring at a "representative sample of user sites" is exceeded.
QA/QC procedures to be applied:	Dispatch of compost will be included in the plant's integrated management system (certified to ISO 9001). Compost yields (as a percentage of EFB) will be tracked monthly
Any comment:	

B.7.2 Description of the monitoring plan:

The monitoring plan has been designed to integrate the measurement and record keeping of the data and parameters listed above within the Palmeras' management system, certified to the ISO 9001 standard.

Classification of Data and Parameters

Type of Monitoring	***Data and Parameters***
Continuous automated monitoring with monthly register by the environmental coordinator	$Q_{ww,y}$ EC_y $Q_{y,ww,runoff}$
Continuous monitoring by lots with manual register by operators	Q_y FC_{Diesel}
Sampling onsite with manual register by operators	$Q_{y,Portion}$
Sampling with offsite analytical determination	$BOD_{inflow,y}$ $COD_{y,ww,runoff}$
Annual photographic monitoring	Adequate Soil Application of Compost
Annual monitoring of CDM variables	$MD_{y,reg}$ GWP_CH_4 TDL NCV_{Diesel} $EF_{CO2,Diesel}$
Integrated QA/QC	Compost Quality Control Program

Monitoring Equipment

Monitoring equipment will be inventoried and included within Palmeras' registry of measurement equipment items.

Maintenance and calibration requirements for monitoring equipment will be included within Palmeras' schedule for maintenance and calibration of measurement equipment items. Maintenance will be carried out by preventative maintenance services. Calibration will be contracted with registered service providers.

Monitoring equipment items are:

- Truck scale
- Diesel fuel pump
- Wastewater flow meter
- Compost plant runoff water flow meter
- Compost plant power meter
- Portable oxygen probe with 1m lance
- Temperature probe and humidity measurement for the Compost Quality Control Program

Operational and Management Structure

The operational and management structure for monitoring emission reductions assimilates into Palmeras' integrated management system (comprising both quality and environmental management), certified to the ISO 9001 standard:

- This project activity falls within the scope of the management structure for the production processes, overseen by the plant manager.
- The scope of Palmeras' quality control plan will be enlarged to include the Compost Quality Control Program.
- Monitoring equipment for this project activity and their maintenance and calibration requirements will be added to their respective registers within the integrated management system.
- Formats for recording data and data registers will be listed within the integrated management system.

The responsibilities of Palmeras' personnel for monitoring activities are as follows:

Plant Manager	Global responsibility for operating the compost plant and monitoring operational data
Quality Coordinator	Record keeping of monitoring data
Environmental Coordinator	Recording of monitoring data except those by lots and CDM variables
Operators	Recording of monitoring by lots
Preventative Maintenance Services	Maintenance and calibration of monitoring equipment

Palmeras' CDM coordinator or advisor will carry out monitoring of CDM variables and prepare the monitoring reports and will also review the operational monitoring data.

Data Collection and Archiving

Within the integrated management system, data collection and archiving is managed as follows:

- Global procedure for document control and registry
- Predesigned formats for data collection
- Control of individual data registers (including access rights and data retention schedules)

Data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Additional Monitoring Considerations

Erroneous or missing measurements

Provisions for erroneous or missing measurements will only apply to those five parameters that are monitored continuously (Q_y, $Q_{y,ww,in}$, EC_y, FC_{Diesel}, and $Q_{y,ww,runoff}$). If specific CDM guidelines for erroneous or missing measurements are published, they will be applied. Otherwise, this project activity will use the following conservative procedures.

Missing data that are used to calculate baseline emissions will be set to the 10^{th} percentile of their observed values, prorated if necessary by instrument downtime. Missing data that are used to calculate project emissions will be set to the 90^{th} percentile of their observed values.

Erroneous measurements will be detected through the periodic calibration of the respective instruments if the error determined through calibration exceeds the precision limits specified by the manufacturer. A correction factor will be defined based upon the error determined at calibration and the most conservative of the upper or lower bound of the instrument precision. This correction factor will be applied to all data points from the previous calibration, including, if applicable, a retroactive correction for previous monitoring periods.

Emergency Conditions

Protection of worker safety during emergency conditions at the Palmeras' mill could lead to abandonment of the compost plant, thus halting windrow turning and possibly leading to unintentional emissions if compost piles decompose anaerobically. In case the compost plant is abandoned due to an emergency condition, a measurement campaign to determine oxygen content (as per parameter $Q_{y,Portion}$ in section B.7.1) will be carried out within three working days after having achieved process normalcy.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

30/04/2010, completed by:

Aretech Cambio Climático, S.A.
La Estrada, 12
28034 Madrid

tel. +34 598 0196
fax. +34 556 7255

Contact:

Laurence W. (Larry) Philp
Managing Director

lphilp@aretechgroup.com

Aretech Cambio Climático is a project participant.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

18/01/2011 (date of signing contract to order Window turner; the wire transfer for the initial payment was carried out 20/01/2011).

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

25 years, 0 months.

The technical lifetime of the investment in fixed plant and equipment for a composting facility is expected to be some 25 years. The technical lifetime of the major mobile equipment item (Windrow turner) is expected to be 10 years. The compost plant of the project activity will remain operational for the stated lifetime if the Windrow turners are replaced at the end of their technical lifetime.

C.2 Choice of the crediting period and related information:

This project activity has chosen a renewable crediting period.

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/01/2013 or registration date, if later.

C.2.1.2. Length of the first crediting period:

7 years, 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

Environmental impact analysis is mandatory for certain types of activities since 1993[15]. This legal framework distinguishes three classes of activities and their respective requirements:

- Highest impact activities: These undergo a two-phase environmental impact analysis. The first phase is an environmental evaluation of all alternatives. A subset of these is chosen by the authority to undergo a full environmental impact analysis. If approved, the environmental licence is issued at the national level by the Ministry of Environment.
- High impact activities: These undergo a full environmental impact analysis. If approved, the environmental licence is issued at the national level by the Ministry of Environment.
- Moderate impact activities: These undergo a full environmental impact analysis. If approved, the environmental licence is issued at the regional level by the authorized agency.

Activities that are not listed within the regulatory framework are considered to be low impact, and thus do not require environmental impact analysis or an environmental licence to operate.

Composting is not listed in either Law 99/1993 or Decree 1220/2005. Therefore, the host Party does not require an analysis of the environmental impacts of this project activity.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

The environmental impacts of the project are considered negligible, whereas the environmental benefits are substantial. Therefore the net impacts of the project are considered beneficial.

[15] Law 99/1993. The listing of activities subject to environmental impact analysis and licensing is fully developed by regulation under Decree 1220/2005.

Transforming wastes into useful products, such as compost in this project activity, is deemed high priority within the Colombian government's waste management policies[16].

SECTION E. Stakeholders' comments

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

Local stakeholders were invited to a public meeting that was held in the El Copey Labour Union Hall on 28/04/2010. The meeting was announced previously in the El Copey Town Hall, as per Colombian CDM requirements[17]. A total of 50 persons attended the public meeting, representing:

- Local and regional government agencies
- NGOs and associations
- Private enterprises
- Local farmers
- Educators and university students
- Other interested members of the local community

All attendees were handed out a hard copy of the Spanish project summary at the meeting. This same project summary had been deposited in the town hall one month prior to the meeting, for consultation. After the project sponsors explained the project and the CDM process, the meeting was opened for comments, observations, and questions. Notes were taken during the meeting's commenting round. The entire meeting was recorded on DVD. A summary of the meeting with an inventory of the comments was prepared in Spanish by the Project participants.

E.2. Summary of the comments received:

No negative comments have been received in the context of the project. Many participants offered positive comments, recognizing the contribution of the Project to the region's sustainable development. A total of 21 comments were registered during the meeting and are summarized below:

Number of Comments	Summary of Comments
7	Congratulations to the Project.
4	Questions about the CDM process and other potential regional opportunities for CDM projects.
3	Questions about specific aspects of the Project and its compost technology.
3	General comments about regional environmental management issues, above and beyond the scope of the Project
1	Question about regional environmental and water resource management

[16] National waste management policy is published in various documents and summarized at http://www.minambiente.gov.co/contenido/contenido.aspx?catID=355&conID=595, accessed on 17 August 2011

[17] Resolution 551 / 2009 of the Ministry of Environment, Housing, and Territorial Development

1	Question about environmental management at Palmeras, above and beyond the scope of the Project.
1	Request for more public meetings of this nature about regional environmental management issues
1	Prayer for meeting attendees and the environment in general

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

No negative comments were received and hence, there was no need to take due account of the comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Palmeras de la Costa S.A.
Street/P.O.Box:	Calle 75 No. 59-69
Building:	
City:	Barranquilla
State/Region:	
Postfix/ZIP:	
Country:	Colombia
Telephone:	+57 5 360 0343
FAX:	+57 5 353 2517
E-Mail:	amanotas@palmeras.com.co
URL:	
Represented by:	
Title:	Gerente General
Salutation:	Dr.
Last Name:	Manotas Carbonell
Middle Name:	
First Name:	Alberto
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Aretech Cambio Climático S.A.
Street/P.O.Box:	La Estrada, 12
Building:	
City:	Madrid
State/Region:	
Postfix/ZIP:	28034
Country:	Spain
Telephone:	+34 91 728 30 95
FAX:	+34 91 556 72 55
E-Mail:	lphilp@aretechgroup.com
URL:	www.aretechgroup.com
Represented by:	
Title:	Managing Director
Salutation:	Mr.
Last Name:	Philp
Middle Name:	William
First Name:	Laurence
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project activity does not involve public funding or official development aid.

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

A4.1 – Certificate of Palmeras' Management System

IQNet

THE INTERNATIONAL CERTIFICATION NETWORK

CERTIFICATE

IQNet and
ICONTEC
hereby certify that the organization

PALMERAS DE LA COSTA S.A.

Calle 75 No. 59-69 Barranquilla, Atlántico
Planta de Fabricación El Copey, Cesar
(Colombia)

for the following field of activities:

Producción y entrega de aceite crudo de palma, aceite crudo de palmiste y torta de palmaste

Production and delivery of crude palm oil, crude palm kernel oil and palm kernel meal

has implemented and maintains a

Quality Management System

which fulfills the requirements of the following standard

ISO 9001:2008

Issued on: 2009 08 19

Validity date: 2012 09 28

Registration Number: CO-SC 1680-1

René Wasmer
President of IQNet

Fabio Tobón
Executive Director of ICONTEC

ICONTEC

IQNet Partners*:
AENOR Spain AFAQ AFNOR France AIB-Vincotte International Belgium ANCE Mexico APCER Portugal CISQ Italy CQC China CQM China CQS Czech Republic Cro Cert Croatia DQS Germany DS Denmark ELOT Greece FCAV Brazil FONDONORMA Venezuela HKQAA Hong Kong China ICONTEC Colombia IMNC Mexico Inspecta Certification Finland IRAM Argentina JQA Japan KFQ Korea MSZT Hungary Nemko AS Norway NSAI Ireland PCBC Poland Quality Austria Austria RR Russia SAI Global Australia SII Israel SIQ Slovenia SIRIM QAS International Malaysia SQS Switzerland SRAC Romania TEST St Petersburg Russia YUQS Serbia
IQNet is represented in the USA by: AFAQ AFNOR, CISQ, DQS, NSAI Inc. and SAI Global
* The list of IQNet partners is valid at the time of issue of this certificate. Updated information is available under www.iqnet-certification.com

A4.2 Sampling Plan for Compost Pile Oxygen Content

A4.2.A Sampling Design

Objectives and reliability requirements

The objective is to determine the fraction of the compost pile over the crediting period that is produced in the presence of less than 8% oxygen with 90% confidence and 10% precision.

Target population

The target population is the oxygen content within the production of the compost at all points in time over the crediting period.

Sampling method

Simple random sampling will be used, since the compost piles are expected to be homogeneous.

Sample size

Since the population is a continuous medium (oxygen within the compost piles), the population size is infinite, and the approximate equation can be used (part 56, "Guidelines for sampling and surveys for CDM project activities and programme of activities" version 02.0):

$$n \geq \frac{1.645^2(1-p)}{0.1^2 \times p}$$

Where p is the percentage of compost that is produced in the presence of less than 8% oxygen. According to the compost quality management plan (appendix A4.4), the oxygen content should always be above 10%. Therefore, the process target is that this fraction is zero. Since composting is a biological process, upsets might occur due to a number of reasons. The ex-ante emission reduction calculation assumes a conservative value of 20%. The sample size is calculated based on the most conservative assumption possible for a proportion: 50%. This value of 50% is introduced in the above equation to yield:

$n \geq 271$

Sampling frame

The sampling frame is the set of compost piles each time sampling is carried out.

A4.2.B Data to be Collected

Field measurements

Each sampling campaign will be carried out by measuring the oxygen content with a portable, self-calibrating probe, in all compost piles. Sampling campaigns will be carried out throughout the year to avoid any seasonal bias. The readings will be recorded manually and entered into a spreadsheet.

Quality assurance / Quality control

The overall quality control and assurance strategy is based on two key elements:

- Data quality is assured through the self-calibration of the portable oxygen meter.
- Data collection and management will be handled through the compost quality control system.

Non-sampling errors such as refusals and non-response do not apply to this sampling plan. No outlier data will be excluded from the dataset.

Analysis

The fraction *(p)* will be determined by dividing the number of readings under 8% by the total number of samples taken. The standard error for *p* will be determined by the conservative equation (part 256, "Guidelines for sampling and surveys for CDM project activities and programme of activities" version 02.0) as:

$$se = \sqrt{p\ *(1-p\ )/n}$$

The check on meeting the reliability requirement will be based on the larger of the two proportions (part 9, "Standard for sampling and surveys for CDM project activities and programme of activities" version 03.0). This check will determine the precision (1.645 * standard error), the 90% confidence level (± precision), and the relative precision (precision divided by the larger of the two proportions). The relative precision will be compared to the objective of 10%.

A4.1.C Implementation

Implementation plan

Data collection will be carried out by the compost plant operators. They will be trained in the use of the self-calibrating, portable oxygen probe and the manual recording formats.

Failure to achieve the target precision level

This sampling plan, overdesigned by assuming a 50% proportion value to determine sample size, assures that the target precision level will always be achieved.

A4.3 Sampling Plan for Chemical Oxygen Demand

A4.3.A Sampling Design

Objectives and reliability requirements

The objective is to determine the biological or chemical oxygen demand (BOD / COD) of the wastewater used in composting and the runoff water with 90% confidence and 10% precision.

Target population

The target population is the BOD in the wastewater as well as the COD in the runoff water.

Sampling method

Simple random sampling will be used, since the wastewater and runoff water streams are expected to be homogeneous.

Sample size

Since the population is a continuous medium (BOD/COD within the wastewater and runoff water streams), the population size is infinite, and the approximate equation can be used (part 88, "Guidelines for sampling and surveys for CDM project activities and programme of activities" version 02.0):

$$n \geq \frac{1.645^2 V}{0.1^2}$$

Where V is the relative variance $(SD/mean)^2$.

Wastewater COD has been measured historically at the Palmeras' site for compliance with existing regulations. Measurements taken during 2009 (in compliance with part 26 of AMS III.H v16.0) and reported in the emission reduction calculation spreadsheet show:

Sample Mean	59.69	g/l
Sample Variance	55.41	g^2/l^2

The compost plant has yet to be built. Therefore, historical data is not available for the COD in runoff water. Nevertheless, runoff water will be generated from wastewater that is not absorbed by the compost pile. It thus can be assumed reasonably for the design of the sampling plan that runoff water COD will have similar parameters to the wastewater.

Based on the above data, V is calculated to be 0.01555. Substituting this value in the above equation yields:

$n \geq 4.2$

This value is less than 30. According to part 12, "Standard for sampling and surveys for CDM project activities and programme of activities" version 03.0, the minimum sample size of 30 is chosen.

Sampling frame

The sampling frame is determined by the grab samples taken of wastewater and runoff water.

A4.3.B Data to be Collected

Field measurements

Measurements and data will be generated through the analysis of the grab samples in a certified laboratory. The field objective is to obtain grab samples periodically. Sampling campaigns will be carried out throughout the year to avoid any seasonal bias.

Field data will document the time and location of the grab samples.

Analytical results of the BOD and COD determinations for wastewater and runoff water will be documented in laboratory results.

Quality assurance / Quality control

The overall quality control and assurance strategy is based on two key elements:

- Data quality is assured through the standardized procedures of the accredited laboratory.
- Data collection and management will be handled through Palmeras' process control system.

Non-sampling errors such as refusals and non-response do not apply to this sampling plan. No outlier data will be excluded from the dataset.

Analysis

The reported values for wastewater and runoff water in monitoring reports will be the average of all values taken during the monitoring period. The standard error (se) of the samples will be determined statistically.

The check on meeting the reliability requirement will determine the precision (1.645 * standard error), the 90% confidence level (± precision), and the relative precision (precision divided by the mean). The relative precision will be compared to the objective of 10%.

A4.3.C Implementation

Implementation plan

Grab sampling will be carried out by qualified technicians from Palmeras' process control laboratory. Analytical determinations of BOD and COD will be carried out by an external laboratory that is accredited for regulatory compliance in the host country.

Failure to achieve the target precision level

In case the target precision level is not achieved during a monitoring period, additional sampling would not be possible, since the wastewater and runoff water generated over the monitoring period would no longer exist. Therefore, discounting of emission reduction estimates would be the only recourse available to the project proponents.

This project applies the following conservative procedure for such a situation:

In case the actual precision has a higher bound than the target level, the value of BOD_{ww} will be taken to be 10% more than the lower bound of the confidence interval. For example, if BOD_{ww} is determined by sampling to be 40 g/l with a 90% confidence interval between 34 and 46 (15% precision), the value to be used in the monitoring report would be 37.8 (34 ÷ 0.9) and its precision at 90% confidence would be reported as +22%/-10%. The converse would be applied in the case of COD_{runoff}. Under the same numerical example, its value to be used in the monitoring report would be 41.8 (46÷ 1.1) and its precision at 90% confidence would be reported as +10%/-19%.

A4.4 Indicative Preliminary Compost Quality Control Program

Process step	Process description	Parameter to monitor	Specification limit	Recording Frequency	Trigger point	Inspection method	Routine procedure
Making of windrows/mixing of feedstock	➢ Reception of EFB	Type of feedstock	EFB only	Daily	Non EFB	Visual	Identify foreign feedstock and discard
	➢ Eventually mixing with boiler ash ➢ Continuous discharge of EFB and transfer for composting heap building process	Heap height (m)	2.3 m ± 10%		<2.0 m	Visual	Increase height of heaps by adding more material on the top
					>2.5 m	Visual	Decrease height of heaps by removing excess material
		Heap width (m)	6.0 m ± 5%		>6.5 m	Visual	Decrease width of heaps by removing excess more material
					<5.5 m	Visual	Increase width of heaps by adding more material
	➢ Spraying of POME on the compost heap ➢ Mixing by turning of heaps with windrow turner	Moisture	50-65%		>65%	Portable Moisture Probe	Cease POME spraying
					<50%	Portable Moisture Probe	Increase POME spraying

A4.4 Indicative Preliminary Compost Quality Control Program

Composting process: active phase (key parameters to ensure aerobic conditions)	➢ Regular turning of windrows and spraying of POME up to day 55 (indicative time) ➢ Maintaining high decomposition rate under aerobic conditions ➢ Regular monitoring to measure the benchmark of the composting process	Temperature (ºC)	45-65ºC	Daily	>65ºC	Portable Temperature Probe	Turn windrow (High temperature indicates rapid decomposition and oxygen depletion. Turning is required to replenish oxygen content to avoid entering into anaerobic conditions)
		Oxygen(%)	10-15%	Daily	<10%	Portable Oxygen Probe	Turn windrow (Turning is required to replenish oxygen content to avoid entering into anaerobic conditions)
		Moisture(%)	50-65%	Weekly	>65%	Portable Moisture Probe	Cease POME spraying (excessive moisture content could lead to anaerobic conditions)
					<50%	Portable Moisture Probe	Increase POME spraying (Low moisture content could prolong the composting process but does not impact the aerobic conditions)
Curing phase	➢ Reception of composted material for curing process ➢ A minimum of 15 days period to cool down and dry the active material ➢ Curing inspection process to ensure material is suitable to be released	Moisture (%)	25-30%	Weekly	>35%	Portable Moisture Probe	Extend curing period to air dry the material
		Temperature (ºC)	Ambient (~34ºC) + 10ºC	Weekly	>45ºC	Portable Temperature Probe	Extend curing process; pending for rework/corrective action
		C: N Ratio	20:1 – 40:1	6 per year	<20:1	Lab analysis	Change mixing / additive guidelines
					>40:1	Lab analysis	Change mixing / additive guidelines

Note: This indicative quality control plan is subject to modification based on Palmeras' commitment to continuous improvement.