CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

Promotion of POME and EFB Co-Composting
Version 2
15/12/2012

A.2. Description of the small-scale programme of activities (PoA):

(i) General operating and implementing framework of PoA

The CDM Programme of Activities, "Promotion of POME and EFB Co-composting" (hereinafter referred to as PoA) involves co-composting of palm oil mill effluent (POME) and empty fruit bunches (EFB) at palm oil mills. The compost produced will be applied on the plantations that supply the mills. Methane emissions generated from the anaerobic treatment of POME will be avoided.

This PoA will include (i) installing co-composting plants at existing palm oil mills; and (ii) installing co-composting plants instead of anaerobic POME treatment systems at new palm oil mills. The host palm oil mills will construct and operate the co-composting plants as "CPA Implementer(s)" for this PoA.

Gestora de Programa Marco Palma, S.L. is the "Coordinating / Managing Entity" (hereinafter referred to as CME). The CME has been incorporated specifically to manage and coordinate this PoA. The CME will carry out the following functions for PoA implementation:

1. Compile information dossier on potential CPAs
2. Assess potential CPAs with regards to the eligibility criteria
3. Prepare Design Documents for eligible CPAs
4. Coordinate the DOE validation and inclusion of CPAs
5. Publish detailed monitoring guidelines and requirements for CPAs
6. Collect monitoring results from CPAs
7. Prepare monitoring reports for the PoA
8. Coordinate the DOE verification of CPA and PoA monitoring reports
9. Manage CER transfers and/or sales according to commercial arrangements established with CPAs
10. Organize forums for information exchange amongst CPAs participating in the PoA

(ii) Policy/measure or stated goal of the PoA

Oil palm crop yields (measured in tons of oil per hectare) are significantly greater than any other vegetable oil crop. Within the past several years, oil palm has overtaken soy beans as the largest global vegetable oil crop. The FAO predicts continued growth within the oil palm sector, some 80% stemming from increasing yields of existing plantations and the balance from new area expansions.[1]

[1] P. Thoenes, FAO Trade and Markets Division, in "*Prospects for world supply & demand of vegetable oils - global challenges and implications for the oil palm agro-industry", September 2009 and in "Biofuels and Commodity Markets – Palm Oil Focus", October 2006.*

The process of crude palm oil production generates 2 types of solid waste: Empty Fruit Bunches (EFB), and mesocarp fibres. Also, the liquid Palm Oil Mill Effluent (POME) with a high chemical and biological oxygen demand is generated. The projected increase in oil palm production would also increase the generation of POME and EFB.

Common practice for managing POME involves treatment in a series of anaerobic lagoons. The decomposition of POME in these lagoons generates methane. Technologies exist to capture or avoid this methane production from POME, but they are not required by law in the host country, Ecuador.[2]

The goal of the PoA is to reduce the pollution potential of EFB and POME by implementing an aerobic composting process of these two palm oil mill waste streams. It consists of co-composting EFB that would have been left to decay along with POME. Each CPA under this PoA 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 covered composting plants. 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 plantations that supply the mills.

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

Environment	• Avoidance of methane emissions from anaerobic decay of EFB and POME. • Contribution to the national waste management strategies that place 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. • Farmers receive compost at cost
Economic	• New private investment in the compost plant. • New ongoing economic activity through composting.

(iii) Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

This programme is purely a voluntary initiative undertaken by the CME. There are no mandatory requirements in Ecuador enforcing the composting of EFB and POME. The confirmation that this PoA is a voluntary action by the CME is based on its document of incorporation.

[2] Standard international industry practice is documented in M. Wambeck, "Handbook for Palm Oil Mills", translated version distributed by FEDEPALMA. Additional references documenting common practices in Ecuador are cited under the prevailing practice barrier in section A.4.3.

A.3. Coordinating/managing entity and participants of SSC-POA:

(i) Coordinating or managing entity of the PoA as the entity which communicates with the Board

Gestora de Programa Marco Palma, S.L. is the Coordinating / Managing Entity (CME). The CME has been incorporated specifically to manage and coordinate this PoA.

(ii) Project participants being registered in relation to the PoA. Project participants may or may not be involved in one of the CPAs related to the PoA.

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)
Ecuador (host)[3]	• Gestora de Programa Marco Palma, S.L. (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 programme of activities:

A.4.1. Location of the programme of activities:

A.4.1.1. Host Party(ies):

Ecuador

A.4.1.2. Physical/ Geographical boundary:

All CPAs included in the PoA will be implemented within the geographical boundaries of the host country. All CPAs will be implemented considering all applicable national/sectoral policies and regulations within the host country.

The location of Ecuador within South America is shown in the adjacent map. Palm growing regions and palm oil mills are located throughout the country's geography.

[3] This PoA is approved by the Ecuadorian DNA and Gestora de Programa Marco Palma, S.L. is authorised as CME in communication "Oficio Nro. MAE-D-2012-0659" dated 20/08/2012.

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

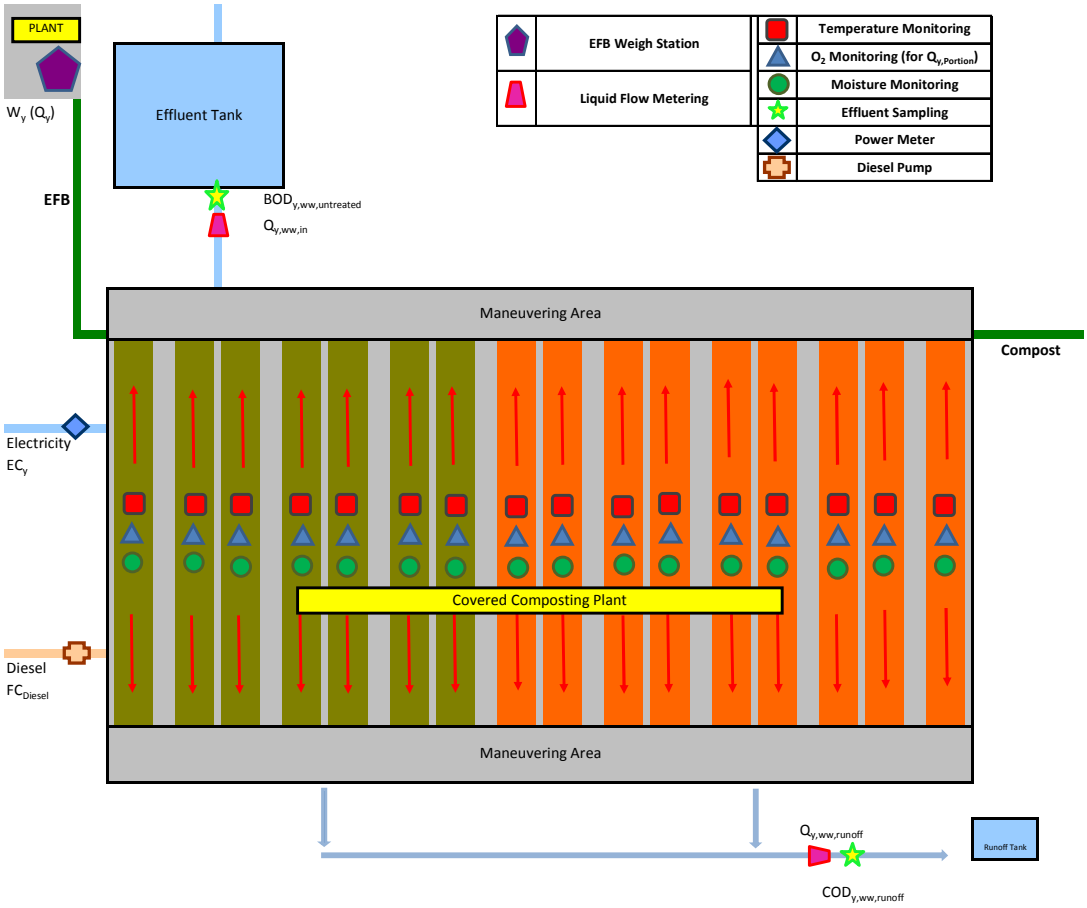
A typical CPA is a small scale project activity and falls under the category **III.F** according to the Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM project activities. It is an "***Avoidance of methane emissions through composting***" project, diverting POME from anaerobic open lagoons that generate methane to be used in an aerobic co-composting process along with solid biomass waste. This type of project activity falls under sectoral scope 13 of the CDM: Waste Handling and Disposal.

Each CPA will consist of one composting plant for EFB and POME associated with one or more palm oil mills. The host palm oil mills can be either existing mills or newly constructed (Greenfield) mills. The composting plants will be newly constructed, not expansions of existing facilities (with the exception of existing facilities for compost research, development, and/or demonstration).

A.4.2.1. Technology or measures to be employed by the SSC-CPA:

The co-composting of EFB and POME will be carried out in newly built composting plants at each CPA. Composting sites will be protected from rainwater infiltration by installing roofing systems. Runoff water will be collected and either treated or applied to the compost piles. Because it can accommodate large volumes of wastes, "turned windrow" composting has been selected for this PoA. 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 a composting plant and its monitoring variables.



The compost plant design includes:

- Site preparation and soil compaction
- Composting plant roofing
- Windrow compost pile turner
- 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 of 45-65 ºC) 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 8 to 12 weeks.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

Number	*Eligibility Criteria*	*Validation Documentation*
1	POME will be co-composted with EFB utilizing the Windrow technology.	Compost plant design documentation (technology description and equipment specifications)
2	The compost plant is newly built, not an expansion of an existing compost plant, excluding those for research, development or demonstration.	Compost plant design documentation (site description and layout); and Site visit and/or photographic evidence of compost plant site
3	The compost plant is constructed within the physical boundaries of a host palm oil mill or on a nearby waste management facility within the host country (Ecuador). The host palm oil mill can be either an existing facility or a new (greenfield) facility.	Compost plant design documentation (site description and layout); and Site visit and/or photographic evidence of compost plant site
4	The EFB and POME for the CPA is not involved in another composting project that is registered or under validation as a CDM project activity or as a CPA under another PoA. The SSC CPA is not a debundled component of a large project activity, as defined by applicable CDM guidelines.	Signed declaration by CPA Implementer; and Confirmation by CME through comparison with the CDM web site
5	Emission reductions will be accrued only for methane avoidance from POME, not for EFB or any other biomass that co-composted.	CDM-CPA-DD; and Emission reduction calculation spreadsheet
6	The ex-ante estimate of emission reductions is less than 60 kt CO_2e for each year of the crediting period.	CDM-CPA-DD; and Emission reduction calculation spreadsheet
7	[Except Greenfield Palm Oil Mills] POME is currently treated in anaerobic wastewater treatment lagoons. The physical characteristics, operational design, and precise location of the lagoons are documented.	WWTP design documentation
8	[Greenfield Palm Oil Mills] In the absence of this CPA, POME would be treated in onsite, anaerobic wastewater treatment lagoons. Engineering studies document the physical characteristics and associated costs of such lagoons. This baseline is confirmed through the 4-step process for SSC project activities.	WWTP design documentation
9	The compost will be sold to at cost and applied on the plantations that supply the mill.	Signed declaration by CPA Implementer Note: this parameter is also included in the monitoring plan

Number	*Eligibility Criteria*	*Validation Documentation*
10	The additionality of the CPA is demonstrated via the investment barrier as per the "Guidelines on the demonstration of additionality of small-scale project activities" v09 as follows: An investment comparison analysis carried out according to applicable guidelines for the CPA's site specific conditions demonstrates that the net present value of cash flows from the CPA compost plant, in the absence of CER income, is less than the net present value of cash flows for POME treatment in anaerobic lagoons.	CDM-CPA-DD; and Investment analysis spreadsheet
11	[Except Greenfield Palm Oil Mills] The POME treated by the CPA is included in a valid discharge permit, environmental license, or equivalent	Valid wastewater discharge permit, environmental license, or equivalent
12	The host palm oil mill or waste management facility has carried out an Environmental Impact Assessment (EIA) or can demonstrate that it is not required under national law.	EIA and official notification of EIA approval; or Written demonstration that EIA is not required
13	The project activity is a voluntary action by the CPA participants and not required by national law.	Signed declaration by CPA Implementer
14	The design of the composting plant satisfies all of the following criteria:	
	a) It will be covered to avoid infiltration of rainwater.	Compost plant design documentation
	b) Rainwater, if not segregated from leachate, will be treated as leachate.	Compost plant design documentation
	c) All leachate will be collected and treated to meet discharge standards or recycled to the composting plant.	Compost plant design documentation
	d) Leachate permeation from composting plants will be avoided through an impermeable top layer (i.e. concrete), inner layer (i.e. geomembrane) and/or soil compaction. If compaction is used, potential soil contamination should be monitored in a down-gradient well.	Compost plant design documentation
	e) Compost, once produced, will not undergo thermal / mechanical treatment	Compost plant design documentation
15	The operation of the composting plant will satisfy all of the following criteria:	
	a) Aerobic composting conditions will be demonstrated through a quality control program.	Compost quality control program initial specifications
	b) Process variables will be monitored as per the monitoring protocol.	Monitoring protocol between CPA Implementer and CME

Number	*Eligibility Criteria*	*Validation Documentation*
	c) The adequate soil application of compost on the plantations will be monitored as per the monitoring protocol.	Monitoring protocol between CPA Implementer and CME
	d) Compost, once produced, will not be stored in anaerobic conditions.	Compost plant design documentation
16	The CPA participant has carried out a local stakeholder consultation in accordance with national CDM requirements and CME guidelines.	Local stakeholder consultation report
17	[Greenfield Palm Oil Mills] The palm oil plantations that are under long-term relationships (either contractually or through ownership with the palm oil mill or any of its shareholders) were previously farmlands (either agriculture or livestock) or were classified as degraded lands by national or international agencies. New palm oil mills that are associated with plantations on recently deforested lands or peatlands are expressly ineligible for CPAs under this PoA.	List of palm plantations under long-term relationships Maps showing locations of palm plantations under long-term relationships Maps or studies by national or international agencies showing land use and/or land degradation
18	The sources of financing the investment in the CPA are known. There is neither ODA/public funding from Annex I Parties of UNFCCC nor bilateral or multilateral funding under concessionary terms involved in the CPA.	Signed declaration by CPA Implementer
19	The Windrow turner purchase order and the civil works contract, if they exist at inclusion, demonstrate that the CPA start date is not prior to 20/12/2011.	Windrow turner purchase order; and Civil works contract
20	The CPA has submitted all information required by the DNA.	Specifications of information required by the DNA (either in published regulations or through a specific agreement between the CME and the DNA); and Written evidence of submission
21	The CPA has supplied one of the following documents to establish the baseline WWTP removal efficiency:	- -
	a) Historical records of at least one year.	Evidence for one option a) to d)
	b) If the WWTP does not have one year of historical records, then all historical records of removal efficiency plus a 10-day measurement campaign of removal efficiency.	Evidence for one option a) to d)
	c) [Greenfield Palm Oil Mills] A 10-day measurement campaign of removal efficiency of the WWTP at another palm oil mill that uses the same process technology and has a hydraulic retention time of ±20% of that specified in the documentation for criteria 8.	Evidence for one option a) to d)

Number	*Eligibility Criteria*	*Validation Documentation*
	d) [Greenfield Palm Oil Mills] Value provided by the manufacturer /designer of a Greenfield wastewater treatment plant using the same technology, demonstrated to be conservative, e.g. average values from the top 20 percent plants with lowest emission rate per ton COD removed among the plants installed in the last five years designed for the same country /region to treat the same type of wastewaters as the project activity.	Evidence for one option a) to d)

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

(i) The proposed PoA is a voluntary coordinated action;

Adequate treatment of POME is required by legislation in Ecuador prior to its discharge[4]. Composting, as means of avoiding POME and EFB generation by converting them into a useful product is not required by law in Ecuador. Furthermore, in compliance with eligibility criteria No. 13, each CPA must certify it is carrying out a voluntary activity. Therefore, each CPA included within the PoA is a voluntary activity.

The management and coordination of this PoA is also a voluntary coordinated action. The CME has been incorporated specifically to manage this PoA, as demonstrated by its document of incorporation, and is thus clearly a voluntary initiative.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

As per paragraph 7 of the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities", version 02.1:

> *Additionality shall de demonstrated by establishing that in the absence of CDM, none of the implemented CPAs would occur.*

This PoA chooses to demonstrate additionality for each CPA prior to its inclusion, based on investment comparison analysis to demonstrate the investment barrier to implement each CPA. These procedures are described in sections E.5.1 and E.5.2. This PoA thus ensures the inclusion of only additional CPAs.

The following discussion of barriers is provided to facilitate a better understanding of the context of the additionality for the CPAs. Nevertheless, the demonstration of additionality is carried out for each CPA through investment comparison analysis to demonstrate the investment barrier.

[4] Wastewater discharge in Ecuador is regulated under Annex I to Book VI of the Unified Text of Environmental Legislation.

To comment the context of additionality at the PoA level, barriers are considered in accordance with the "Guidelines on the demonstration of additionality of small-scale project activities" v09. 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 PoA, the investment barrier is demonstrated at the CPA level to establish additionality. Both the prevailing practice barrier and the investment barrier are commented below at the PoA level to provide relevant background information, not as a demonstration of additionality.

Prevailing Practice Barrier

Common practices for managing POME in Ecuador are documented on a plant by plant basis in Annex 3[5]. All of Ecuador's palm oil mills that have prepared EIAs have anaerobic wastewater treatment systems for their POME.

Wastewater treatment of POME is required to meet the previously cited discharge limits in Ecuador. Anaerobic treatment lagoons are common practice and cited in handbooks as standard practice. Nevertheless, anaerobic treatment lagoons generate methane and thus have higher emissions than this PoA's technology – aerobic composting.

Investment Barrier

Eligibility criteria No. 9 requires that CPAs sell compost at cost to the plantations that supply the palm oil mill. This criteria enables the monitoring of the adequate soil application of the compost (required by the applicable methodology) and ensures a social benefit to contribute to the sustainable development of host country. This social benefit stems from the fact that in Ecuador, the average palm plot size is small[6], representing in the majority of cases subsistence farming for many families in rural areas. Selling the compost at cost will enable these small farmers and their families to receive CDM benefits, albeit indirectly.

[5] Annex 3 provides the documentary references and analysis of common practice based on the 20 EIAs published for public comment for the Ecuadorian palm oil sector.

[6] The most recent census carried out for the palm oil sectors in Ecuador demonstrate average plot sizes of 39 hectares, respectively, whereas average plot sizes in leading producer countries, Indonesia and Malaysia, are measured in thousands of hectares. Industry analysts consider such small plot sizes to be a competitive disadvantage due to fragmentation and lack of economies of scale. Nevertheless, supplying compost at cost to many smaller farmers allows for widespread sharing of CDM benefits within this PoA. Source: ANCUPA (National Association [of Ecuador] of Palm Cultivators), 2005 Census.

In carrying out an investment analysis for an individual CPA, if compost is sold at cost, it would appear highly likely that the return on capital investment would not exceed a standard market benchmark. Nevertheless, a rigorous investment analysis should also consider forgone costs, such as avoided wastewater treatment lagoon costs that would result from project implementation. Thus the determination of additionality through the investment analysis, although expected a priori to demonstrate the investment barrier, is to be carried out for each CPA, as per eligibility criteria number 10.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

Not applicable since the PoA is implementing a voluntary coordinated action, not a mandatory policy or regulation.

(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

Not applicable since the PoA is implementing a voluntary coordinated action, not a mandatory policy or regulation.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

The operational and management plan for this PoA is based on written procedures and guidelines to facilitate the multinational operational requirements of the CME. The design of the management system has taken into account the applicable CDM requirements (paragraph 19 of the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities", version 02.1). CME's management system is structured into high level management procedures (with a single digit code), operational procedures (with a double digit code) and operational tools and guidelines (with a three digit code). At validation, the components of CME's management system are as follows:

1. Management commitment to continual improvement
2. Human resource capabilities and responsibilities
   - 2.1. Roles and responsibilities for CME functions
     - 2.1.1. Matrix to demonstrate competencies
   - 2.2. Training and development of competencies
3. Record keeping and control
4. Operational procedures and standard formats
   - 4.1. Procedure to avoid double accounting
     - 4.1.1. Register for Ecuador
   - 4.2. Procedure to carry out technical review of inclusion of CPAs
     - 4.2.1. Technical review protocol
   - 4.3. CME Guidelines for CPAs
     - 4.3.1. Guideline for local stakeholder consultation
     - 4.3.2. Guideline for calculating the cost of compost
     - 4.3.3. Guideline for complying with DNA requirements
   - 4.4. CME Tools and standard formats

4.4.1 - 6 6 Operational tools and formats

To facilitate communication between the CME and CPAs, the tools and guidelines are in Spanish.

Since this management system is subject to continual improvement, its content and possibly even structure can be expected to vary over time. Nevertheless, any changes that a DOE might observe at inclusion of CPAs after validation of the PoA will demonstrate that the system is implemented and subject to continuous improvement.

(i) A record keeping system for each CPA under the PoA,

All data and records described above will be maintained in the CME's document management system (procedure 3 above). Key elements of the record keeping system include:

- Unique identification of each CPA
- Information requirements to initiate the inclusion of a CPA
- Electronic copies of all information provided by the CPA
- Controlled access to electronic information
- Back-up of electronic information
- Conservation of electronic information

(ii) A system/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA,

Eligibility criteria No. 4 of this PoA provides a strict restriction that will avoid double accounting of a new CPA. This criteria is enforced through the following:

- Written acceptance by the CPA Implementer
- Confirmation by the CME by searching CDM projects and PoAs on the CDM website

These considerations are included in operational procedure 4.1 of the management system.

Double accounting of emission reductions is not possible under the monitoring provisions of this PoA (section E.7.2). The biomass and effluents that are composted are monitored upon reception, and then converted into compost. Since these inputs to the process are monitored and then transformed, it would not be possible for another CPA or CDM project activity to utilize them in any fashion. Furthermore, the same would apply were the biomass or effluents to be treated by another CDM project activity prior to reception by this PoA. Emission reductions for avoided biomass decay are not claimed under this PoA. If any biomass that is received for composting has been pre-treated by another CDM project activity, no double accounting would occur, since this PoA does not account for such reductions. If any effluent that is received for co-composting has been pre-treated by another CDM project activity, no double accounting would occur, since such pre-treatment would be reflected in the physical properties of the effluent (specifically BOD) that are monitored for each CPA under this PoA. Nevertheless, these last two situations are contemplated in the procedure to avoid double accounting, so that they can be fully investigated and validated for a CPA to be included.

(iii) ***The SSC-CPA included in the PoA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.***

Eligibility criteria No. 4 of this PoA provides a strict restriction that will ensure that new CPAs are not a de-bundled component of another CPA or CDM project activity. This criteria is enforced as described above.

The confirmation by the CME will be carried out and validated according to the "Guidance for determining the occurrence of debundling for SSC project activities", version 03 (EB 54, Annex 13), and is also included in operational procedure 4.1 above.

(iv) ***The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA;***

The acceptance and awareness of each CPA Implementer is evidenced through signing the PoA adhesion contract.

(v) ***The provisions in case the approved methodology is put on hold or withdrawn***

In case the approved methodology for this PoA (AMS III.F v10.0) is withdrawn or put on hold, applicable CDM procedures would be followed. At validation[7], those procedures are contained in the "Procedures for registration of a programme of activities as a single CDM project activity and issuance of certified emission reductions for a programme of activities", Version 04.1, and would require:

- If the approved methodology is put on hold or withdrawn, for any reason other than for the purpose of inclusion in a consolidated methodology, no new CPAs shall be included to the PoA, in accordance with the timelines indicated in the latest version of the Procedures for the revision of an approved baseline and monitoring methodology by the Executive Board.
- If the methodology, subsequent to being placed on hold or withdrawn, is revised or replaced by inclusion in a consolidated methodology, the PoA shall be revised accordingly. The changes shall be subsequently documented in a new version of PoA (e.g Version 1.1), validated by a DOE and approved by the Board. The Board´s approval defines a new version of the PoA and the generic CDM-CPA-DD. Such revisions to the PoA are not required in cases where a methodology is revised without being placed on hold or withdrawn.
- Once changes have been approved by the Board, the inclusion of all new CPAs shall follow the latest version of the generic CDM-CPA-DD.
- CPAs that were included before the methodology was put on hold, shall apply the latest version of the PoA generic CDM-CPA-DD at the time of the renewal of the crediting period.

A.4.4.2. Monitoring plan:

[7] The validation of this PoA is under the VVM track. The latest version of CDM procedures, including the Project Cycle Procedure, would be followed as applicable.

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.

Monitoring and verification will be carried out for each monitoring period of each CPA under the PoA. Therefore, sampling methods or procedures are not required for verification.

For each CPA, all parameters included in section E.7.1 will be monitored by the CPA Implementer according to the procedures and monitoring framework established in E.7.2 and will be submitted to the CME. The CME will store the data within the document management system. Primary data will be stored by the CPA Implementers.

(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

Verification will occur either separately for each CPA or in groups. In any case, data shall be verified per CPA and the verification status of each CPA will be recorded in the CME's management system.

A transparent system is defined to ensure that no double accounting occurs (please see section A.4.4.1). Double accounting will be avoided by:

- Preparing monitoring reports for each CPA (having a unique geographic location).
- Establishing sequential monitoring periods for each CPA that do not have gaps or overlaps between them (different CPAs included in this PoA can have different monitoring periods).
- Reporting the CPAs' monitoring periods being verified in each monitoring report for the PoA.

With this system, the status of verification for each monitoring period of each CPA can be determined transparently in the PoA's monitoring reports.

A.4.5. Public funding of the programme of activities (PoA):

This PoA does not receive public funding.

Public funding for individual CPAs is limited by eligibility criteria No. 18.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

The starting date of the PoA is 20/12/2011. The starting date of CPAs will not be earlier than 20/12/2011.

B.2. Length of the programme of activities (PoA):

As per the "Procedures for Registration of a Programme of Activities as a Single CDM Project Activity and Issuance of Certified Emission Reductions for a Programme of Activities" v04.1, the length of the PoA is 28 years.

SECTION C. Environmental Analysis

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C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at SSC-CPA level ☒

Site-specific environmental conditions at individual CPAs could affect an EIA. Eligibility criteria No. 12 requires that host palm oil mills have carried out an EIA or can demonstrate that an EIA is not required. Therefore, environmental analysis will be carried out at the CPA level and reported in each CDM-SSC-CPA-DD.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The information provided in this section is merely informative. Documentation on the analysis of environmental impacts will be reported for each CPA.

The environmental impacts of each CPA are considered negligible or minor, whereas the environmental benefits are substantial. Therefore the net impacts of the project are considered beneficial:

- POME, instead of being treated (generating methane and odours) and then discharged is utilized as a raw material for compost.
- EFB, instead of being dumped or mulched is utilized as a raw material for compost.
- Compost is applied on the plantations, thus recycling nutrients and organic matter to the land where they were generated originally.
- A reduction in chemical fertilizer can be expected, thus reducing the life-cycle environmental impact from its use.
- Soil properties in the plantations are enhanced, contributing to sustainable agriculture.

Transforming wastes into useful products, such as compost in this PoA, is deemed high priority within the waste management policies of the host country, Ecuador[8].

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

To be determined at the CPA level as per eligibility criteria 12 and 20.

[8] Ecuador's National Environmental Policy

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level ☒

The geographical region covered by this PoA is deemed too large to correctly identify all potential local stakeholders. Therefore, local stakeholder consultations will be carried out for each CPA prior to its inclusion in this PoA, as per eligibility criteria number 16. Due account of any comments received will be carried out as well at the CPA level.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

To be reported at the CPA level.

D.3. Summary of the comments received:

To be reported at the CPA level.

D.4. Report on how due account was taken of any comments received:

To be reported at the CPA level.

SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

The PoA uses "Small-Scale Methodology III.F: Avoidance of methane emissions through composting", version 10.0. For the baseline wastewater emissions, this methodology refers to "Small-Scale Methodology III.H: Methane recovery in wastewater treatment", version 16.0[9]. The PoA also uses the "Tool to calculate project, baseline and/or leakage from electricity consumption", version 01, and the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", version 02.

[9] This PoA applies one methodology (AMS.III.F v10) to one technology / measure (co-composting). The second methodology cited (AMS.III.H v16) is referred to explicitly by the first. This PoA does not involve multiple methodologies as per parts 28 to 33 of the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programmes of activities", version 02.1.

The approved SSC baseline and monitoring methodology has been revised and approved for use in a PoA by the Board (version 05, EB 33, Annex 34, was the first version approved for PoAs; subsequent versions have included provisions for PoAs).

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

The eligibility criteria for this PoA ensure that all of the relevant applicability criteria of AMS III.F v10.0 are met:

Criteria from AMS III.F v10.0	*Eligibility Criteria*
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). In the project activity, controlled aerobic treatment by composting of biomass is introduced.	1 – Aerobic (Windrow) composting is specified for all CPAs.
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".	1 Only composting is specified for CPAs. No eligibility criteria includes recovery or combustion of landfill gas, controlled combustion of waste, recovery of biogas or co-digestion of organic matters.
3. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.	6 To be confirmed in each SSC-CPA-DD.
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.	1 EFB and POME are biomass wastes from palm oil mills, an agro-industrial activity.
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.	2 Only newly built composting plants are eligible as CPAs. Expansion of existing facilities or an increase in capacity utilization are not eligible under this PoA.

Criteria from AMS III.F v10.0	*Eligibility Criteria*
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.	1 Co-composting of EFB with POME, the example cited, is precisely specified as eligibility criteria.
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.	5 To be conservative, and since individual baselines for EFB management could vary amongst CPAs, baseline emissions for EFB are considered zero.
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.	5, 7, and 8 Baseline wastewater treatment systems are fully specified by the eligibility criteria. Baseline disposal of solid wastes are ignored, to be conservative.
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.	5 CPAs have the flexibility to add other organic matter to the composting mix. Since emission reductions are only accrued for POME, the baseline emissions for all other organic matter is considered zero to be conservative.
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 PoA selects option a) instead of b). Baseline management of EFB (please see section E.4) is considered to be mulching on the plantations, even though their emissions are ignored. Typical waste generation is 6t EFB per hectare of plantation (600 grams per square meter). Therefore, the site can easily accommodate the waste over the crediting period.

Criteria from AMS III.F v10.0	*Eligibility Criteria*
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).	Not applicable, since criteria 8(a) is demonstrated instead of 8(b).
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.	15c Proper soil application of compost will be monitored in each CPA.
11. In case produced compost is treated thermally/mechanically, the provisions in AMS-III.E related to thermal/mechanical treatment shall be applied.	14e Thermal/mechanical treatment of compost is excluded in the eligibility criteria.
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".	9, 15d Compost will be applied in plantations, not landfilled. Compost will not be stored under anaerobic conditions.

Furthermore, AMS III.F has been revised to include specific leakage considerations under PoAs, as per paragraph 26 of version 10.0:

> *In case the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.*

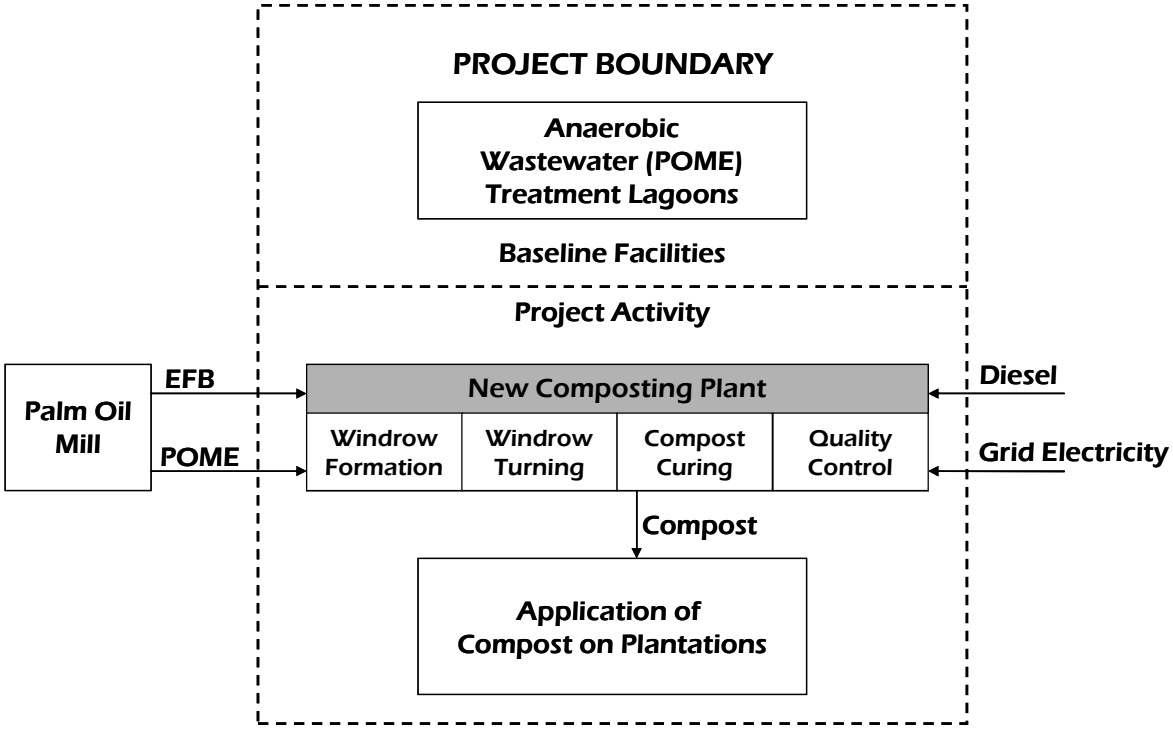
Eligibility criterion 2 requires that only new composting plants can be included in this PoA. No replacement of equipment will be involved in any CPA. Therefore, the leakage effect of the use of the replaced equipment is not applicable to this PoA.

E.3. Description of the sources and gases included in the SSC-CPA 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	*CPAs included in this PoA*
Where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;	To be conservative, baseline emission from EFB decay are ignored, and thus excluded from the project boundary
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;	Baseline treatment for co-composting wastewater is defined as onsite anaerobic treatment lagoons.
Where the treatment of biomass through composting takes place;	Composting will take place onsite at all CPAs.
Where the products from composting (compost) is handled, disposed, submitted to soil application, or treated thermally/mechanically;	Compost will be applied on the plantations associated with the mills that host each CPA. Compost will not be sold for other uses.
And the itineraries between them (a, b, c, and d), where the transportation of waste, wastewater, where applicable manure, product of treatment (compost) occurs.	All of these itineraries are included within the project boundary

Therefore, the project boundary is delimited by the CPA's new composting plant, the host palm oil mill wastewater treatment lagoons, and the plantations that serve the host palm oil mill:



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 are considered GHG neutral.
		CH_4	No	To be conservative, eligibility criteria 5 excludes methane emissions from biomass decay
		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 v10.0 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 are considered GHG neutral.
		CH_4	Yes	Methane emissions from anaerobic pockets during composting process.
	Runoff Water	CO_2	No	CO_2 emissions from biomass sources are 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 v10.0
	Additional Transportation due to Project Activity	CO_2	No	Under baseline 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 by AMS III.F v10.0
		N_2O	No	

Additional organic matter from the mills or third parties, either residues and/or manure, might be incorporated into the composting process. Such additional organic matter is excluded from the project boundary and the baseline emissions to be conservative. Nevertheless, the project emissions from composting consider all matter that is incorporated into the composting process.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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.*

POME Baseline

The eligibility criteria for this PoA contemplate composting plants for both existing palm oil mills as well as new (Greenfield) palm oil mills. For existing palm oil mills, the baseline is determined by existing practice (anaerobic treatment lagoons), as per eligibility criteria number 7. For Greenfield palm oil mills, the baseline scenario is identified as per the 4-step procedure specified in Part 19 of the General Guidelines to SSC CDM Methodologies v17.0:

Step 1

Identify the various alternatives available to the project proponent that deliver comparable level of service including the proposed project activity undertaken without being registered as a CDM project activity.

Technically viable alternatives for treating POME are:

- Anaerobic treatment lagoons (common practice in the host country, as cited previously)
- Anaerobic treatment lagoons with methane recovery and flaring (not as a CDM project)
- Anaerobic treatment lagoons with methane recovery and biogas utilization (not as a CDM project)
- This PoA technology (Co-composting of POME with EFB, not as a CDM project)
- Direct discharge of POME

Step 2:

List the alternatives identified per Step 1 in compliance with the local regulations (if any of the identified baseline is not in compliance with the local regulations, then exclude the same from further consideration).

Direct discharge of POME does not comply with Ecuadorian discharge regulations[10]. Therefore, the above list is modified as follows:

- Anaerobic treatment lagoons (common practice)
- Anaerobic treatment lagoons with methane recovery and flaring (not as a CDM project)

[10] Annex I to Book VI of the Unified Text of Environmental Legislation.

- Anaerobic treatment lagoons with methane recovery and biogas utilization (not as a CDM project)
- This PoA technology (Co-composting of POME with EFB, not as a CDM project)

Step 3:

Eliminate and rank the alternatives identified in Step 2 taking into account barrier tests specified in attachment A to Appendix B of the simplified modalities and procedures of SSC CDM[11].

The two alternatives with methane recovery are add-ons to anaerobic treatment lagoons. Thus they involve higher initial and operating costs than lagoons without methane recovery. Therefore, the two alternatives with methane recovery can be ruled out based on the investment barrier.

The two remaining alternatives are 1) anaerobic treatment lagoons; and 2) this project activity undertaken not as a CDM project activity. To demonstrate the additionality of each CPA, an investment analysis will be carried out between these two alternatives (described in detail in section E.5). The demonstration of additionality by comparing these two alternatives will also confirm anaerobic treatment lagoons as the baseline scenario for POME for each CPA included in this PoA. If the investment analysis does not demonstrate additionality (and hence confirm lagoons as the baseline), then the CPA would not be included in this PoA, as per eligibility criteria number 10.

Step 4:

If only one alternative remains that is:

Not the proposed project activity undertaken without being registered as a CDM project activity; and

It corresponds to one of the baseline scenarios provided in the methodology; then the project activity is eligible under the methodology.

If more than one alternatives remain that correspond to the baseline scenarios provided in the methodology, choose the alternative with the least emissions as the baseline.

This one remaining alternative, anaerobic wastewater treatment in lagoons, is not the proposed project activity and it does coincide with the methodology. Therefore, the project activity is eligible under the methodology and this baseline for POME is confirmed.

EFB Baseline

In accordance with eligibility criteria No. 5 for this PoA, and applying part 7 of AMS III.F v10.0, the baseline emissions for EFB are considered zero.

[11] It is noted that the Attachment A of Appendix B has been replaced by the "Guidelines on the demonstration of additionality for SSC project activities" v09, although the cited text is taken literally from the "General guidelines for SSC methodologies" v17, valid for VVM Track until 31/01/2013.

Common practice for managing EFB in Ecuador is hauling EFB to the plantations (return trips of the trucks that deliver FFB to the mills) and stacking the EFB in piles where they decay naturally and are then mulched.[12] Depending on site-specific circumstances, the decay process can be anaerobic or partially so. Since piling and then mulching is common practice and documented in approved EIAs, it is considered the EFB baseline practice. Nevertheless, to be conservative, the baseline emissions for EFB are ignored.

The key data and parameters for quantifying this baseline scenario will be monitored for each CPA. The key data for estimating baseline emissions ex-ante are:

Data/Parameter	Units	Source/Explanation
FFB Processed	t/yr	Projected production for each CPA host palm oil mill
Effluent	m^3/tFFB	Historic average at host mills or reference value
Effluent BOD or COD[13]	kg/m^3	Historic average at host mills or reference value

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

To demonstrate and assess additionality, a barrier analysis is carried out in accordance with "Guidelines on the demonstration of additionality of small-scale project activities" v09. 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

The investment barrier will be assessed individually for each CPA. Each CPA will have two revenue streams: income from compost sold to plantations and CERs. . Therefore, according to the non-binding best practice examples, a simple cost analysis is not indicated.

The analysis is carried out according to the "Guidelines on the Assessment of Investment Analysis" v05. The two scenarios analyzed are:

[12] Documented for Ecuador in the analysis of EIAs in Annex 3

[13] As explained fully en sections E.6.1 and E.6.2, this PoA selects the option to monitor BOD instead of COD. Nevertheless, if historical BOD data is not available, COD data, and its corresponding emission factor, could be used only for the ex-ante emission reduction calculation. In such a case, only for the ex-ante emission reduction calculation, CPAs could utilize handbook values or an average sector value.

a) Baseline: anaerobic treatment lagoons for POME
b) Project: Co-composting of EFB and POME without CER revenue

The financial indicator chosen is net present value (NPV) of the net cash flows for both scenarios[14]. Additionality is demonstrated through investment comparison for each CPA if the NPV net cash flows of the project scenario are lower than the NPV net cash flows of the baseline scenario.

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

Following is the application of the key criteria from the "Guidelines on the Assessment of Investment Analysis" v05:

Part	***Key Criteria***	***Application for each CPA in this PoA***
3	Period of Assessment	A 10-year assessment period is used. This coincides with the expected technical lifetime of the major equipment item (Windrow turner), although it's accounting lifetime is less. At the end of this period, a CPA could remain operational if a new Windrow turner is purchased, since the investment in fixed plant is expected to have a life of some 25 years. A residual value is applied to assets that are not fully depreciated at the end of the assessment period.
4	Residual Value	Book value of assets will be applied at the end of the period of assessment, in accordance with local accounting regulations. This is conservative, since regulatory assets are sunk costs and their fair value could be argued to be zero.
5	Taxation and Depreciation	The discount rates applied to calculate NPV are after tax. Therefore, taxation is included as a cost but depreciation is not considered as a cash flow.
6	Input Values	All input values will be listed in each CDM-SSC-CPA-DD and valid at the time of decision
7	Implementation Restart	To be applied only to CPAs that restart implementation
8	Spreadsheet	An investment analysis spreadsheet will be annexed to each CDM-SSC-CPA-DD
9-11	Project versus Equity Basis	The NPV analysis will be carried out considering any specific loan or other financing vehicle as a cost only for the composting scenario (b). To be conservative, the baseline scenario will consider only equity financing. Therefore, the basis of the analysis is equity cash flow (after tax, after interest and loan repayment, considering equipment depreciation for tax purposes but not as a cash flow).
12, 18	Appropriate Benchmarks	Since the analysis is carried out on an equity basis, the appropriate discount rate should be on the same basis. WACC considerations do not apply to an analysis based on equity investment and equity cash flows.

[14] As is common convention for cash flow analysis, cash inflows are assigned a positive value (+) and cash outflows are assigned a negative value (-).

Part	*Key Criteria*	*Application for each CPA in this PoA*
13	Standard versus company-specific discount rate	Composting plants could be developed by the host palm oil mill owner or by a third-party waste manager. Therefore, the discount rate should be a standard value in the market. The values from the appendix to the guidelines are thus chosen. The values are consistent with the basis of the financial analysis (after tax, equity basis, and real).
15	Equity Discount Rate	Since standard in the market discount rates apply, the values from the appendix to the guidelines are used. These values are after tax and real, and thus consistent with the equity basis of the analysis.
14, 16, 17	Internal Company Benchmarks	Do not apply, since the investment analysis must use standard in the market benchmarks
19	Method of Analysis	The investment analysis calculates the NPV of both the project and baseline scenarios. Investment comparison is chosen since it is the indicated analysis method for cases where the baseline requires investment and is more conservative than a benchmark analysis for cases where the baseline scenario includes costs but not investment[15]. The investment analysis demonstrates additionality if the NPV of the project scenario is lower than the NPV of the baseline scenario.
20-21	Sensitivity Analysis	Sensitivity analyses will be carried out for investment costs (±10%) and operating costs (±10%) for both the baseline and project scenarios. Such variations in cost could occur due to differences in physical volumes (i.e. effluents) or in unit prices. An additional sensitivity analysis will be carried out in order to identify under what conditions variations in the result would occur (i.e. the project scenario becomes more attractive than the baseline).

The following data sets and sources will be used in the investment comparison spreadsheet of each CPA:

1. <u>Project Material Flows</u>

Data Item	*Source / Comments*
Projected FFB Processed	These data items will be sourced from the compost plant design documentation and will be identical to the values used in the ex-ante estimation of emission reductions.
Projected EFB Composted	
Projected POME Co-Composted	
Projected Compost Production	

2. <u>WWTP Costs</u>

[15] The baseline scenarios for all CPAs will include POME management costs. Some CPAs might also require investment in their baseline scenarios (Greenfield palm oil mills and existing mills that require additional treatment capacity). Therefore, the NPV of all baseline scenarios will be negative. Investment comparison is thus more conservative than a benchmark analysis, since the former requires the project scenario NPV to be less than a negative number, whereas the latter would only require the project scenario NPV to be less than zero.

Data Item	*Source / Comments*
Investment Cost	For existing host palm oil mills, this value will be ignored[16], unless the lagoons require capacity additions to meet projected FFB processing, in which case, the capacity additions will be treated as per Greenfield mills. For Greenfield mills, WWTP investment cost will be taken from the WWTP design documentation and broken down as follows: • Land • Site preparation and civil works • Buildings • Equipment and installation
Operating Cost	For existing host palm oil mills, operating costs will be derived from accounting records (on a per tonne of FFB basis), if available. For Greenfield mills, operating costs will be taken from the WWTP design documentation, if available. If data is not available, either existing or Greenfield mills could use the following, conservative benchmark for anaerobic treatment lagoon operating costs[17]: US$ 0.11 per cubic meter[18]

3. Compost Plant Investment Cost

Data Item	*Source / Comments*
Land	These data items will be sourced from the compost plant design documentation.
Site preparation and civil works	
Buildings	
Fixed Equipment and Installations	
Mobile Equipment	

4. Compost Plant Operating Costs

[16] An existing mill might have a net asset value for lagoons on the books, pending depreciation. Depreciation is not a cash flow, but could affect the tax calculation, that is a cash flow. Such a net asset value of the lagoons can be ignored, since it would affect both the baseline and project scenarios, and thus not impact the investment comparison between the two scenarios. Furthermore, in the project scenario, such a net asset value of the lagoons might be eligible for write-down, thus providing an earlier cash flow in terms of a tax benefit. Therefore, ignoring this concept is conservative.

[17] Operating costs for anaerobic lagoons are considered "minimal" according to the US EPA Wastewater Technology Fact Sheet. The benchmark is considered conservative since it is based on municipal WWTP costs.

[18] Benchmark derived from published technical literature as well as CME proprietary information. This benchmark is the highest of the observed values.

Data Item	*Source / Comments*
Electricity consumption	These data items will be sourced from the compost plant design documentation and will be identical to the values used in the ex-ante estimation of emission reductions.
Diesel fuel consumption	
Electricity price	For existing palm oil mills, to be derived from recent accounting records. For Greenfield mills, based on contracted terms or market values.
Diesel fuel price	
Personal	These data items will be sourced from the compost plant design documentation.
Other Operating Costs	

5. Depreciation Periods

Data Item	*Value*	*Source / Comments*
Land	N/A	Depreciation periods in years. Values shown are valid at validation of the PoA[19]. Values to be applied are those valid at the time of decision making.
Improvements, constructions and buildings	20	
Fixed Equipment and Installations	10	
Mobile Equipment	5	

6. Compost selling price

As per PoA eligibility criteria No. 9, compost is to be sold at cost. The compost selling price will be determined in the investment comparison spreadsheet by summing the operating costs, annual depreciation, and taxes, and then dividing the result by the expected compost production. This represents the full accounting cost of the compost.

7. Financial Data

Data Item	*Value*	*Source / Comments*
Effective corporate income tax rate[20]	33.7%	Values shown are valid at validation of the PoA[21]. Values to be applied are those valid at the time of decision making.

[19] Depreciation periods for Ecuador are defined in Executive Decree 1051 of 2008. These values are valid at validation of this PoA but will not be considered fixed parameters.

[20] In the baseline scenario, anaerobic lagoons, wastewater treatment costs are associated with a new or existing palm oil mill. Wastewater treatment costs would be deductible against income from vegetable oil revenues, thus providing a tax credit. For existing palm oil mills, CPAs could either demonstrate that pre-tax profits are greater than wastewater treatment costs from accounting records over the most recent three years and thus apply the effective corporate income tax rate as a credit, or apply a conservative tax rate of zero in the baseline scenario, thus ignoring the tax credit. For new (Greenfield) palm oil mills, the tax credit will be considered in the baseline scenario at the

Discount Rate	17.0%	Attachment to EB62, Annex 05 for sectoral scope 13

Since the financial analysis is carried out on a real basis, estimates for inflation or price escalators are not used.

8. External Financing

To be conservative, this is only considered for scenario B), composting plant implemented not as a CDM Project, based on confirmed financing at validation of the inclusion of the CPA in this PoA. The following data items will be compiled for each external financing instrument.

Data Item	***Source / Comments***
Loan Principal	These data items will be sourced from firm financing arrangements for the compost plant.
Loan Duration	
Grace Period	
Interest Rate (APR)	

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

Methodology AMS III.F v.10.0, as well as other methodologies and tools that it references, allows for various methodological choices. The following options have been chosen for all CPAs within this PoA and are fully justified in section E.6.2:

Citation	***Methodological Choice***
par6 AMS III.F v10.0	Wastewater is co-composted with biomass (EFB)
par7 AMS III.F v10.0	To be conservative, avoided methane emissions from the decay of solid biomass are ignored
par14 AMS III.F v10.0	Baseline emissions for wastewater are calculated according to par20, AMS III.H v16.0
par20 AMS III.H v16.0	Project activities may monitor either COD or BOD and use the corresponding emission factors. This PoA selects the BOD option, as justified in section E.6.2

effective corporate income tax rate, since it would form part of the investment decision basis to construct the new mill.

[21] The effective corporate income tax rate in Ecuador includes a mandatory, deductible entitlement of 15% of pre-tax profits and a 22% rate on the balance of profits as per the Workers' Code of 2005 and the Production Code of 2010, respectively. The consideration of the mandatory entitlement as an effective corporate tax is established by the World Bank 2010 Report No. 46551 EC entitled "Ecuador: Diversification and Sustainable Growth in an Oil-Dependent Country".

Citation	*Methodological Choice*
par18 AMS III.F v10.0	The emission factor for methane from composting may be selected on a dry or wet (as-is) basis. This PoA selects the wet (as-is) basis to be consistent with the monitoring methods. The emission factor for methane from composting may be set to zero subject to specific monitoring requirements via sampling. This PoA selects this option, proposing and justifying the indicated sampling and monitoring (section E.6.2 and Annex 4.1).
par27-8 AMS III.F v10.0	Parameters related to electricity consumption are calculated according to the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" v01. Parameters related to fossil fuel consumption are calculated according to the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" v2 This PoA selects a more conservative grid loss factor than the 10% supplied in this specification.
am-tool-05 v1[22]	The conservative default emission factor value of 1.3 tCO_2/MWh is used, thus covering all three generation scenarios supported by the tool (options A2 and B2, as well as cases C.I, C.II and C.III) The conservative default grid loss value of 20% is used
am-tool-03 v2[23]	Fuel consumption can be monitored en either mass or volume units. This PoA selects volume units as justified in section E.6.2
am-tool-03 v2	Option B (net calorific value and fuel-specific emission factor) is chosen over Option A (carbon content of fuel) since the project uses only a commercial liquid fuel (diesel) and the carbon content is not available.

Leakage

The project technology does not include any equipment transferred from other activities 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.

As described previously in section E.2, paragraph 26 of AMS III.F v10.0 does not apply, since all CPAs are new facilities, not equipment replacement.

Competing uses for the biomass

The following applies the procedures for competing uses for the biomass.

The sources cited previously regarding common practice for managing EFB[24] clearly demonstrate:

[22] "Tool to calculate project, baseline and/or leakage from electricity consumption", version 01.

[23] "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion", version 02.

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

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

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

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

To be conservative, and applying eligibility criteria No. 5, the terms $BE_{CH4,manure,y}$ and $BE_{CH4,SWDS,y}$ are set to 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 equivalent term $BE_{ww,treatment,y}$ be calculated as follows:

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

Where:

$Q_{ww,y}$	Volume of wastewater entering the co-composting facility in the year *y* (m^3)
$COD_{inf\ low,y}$	Chemical oxygen demand of the wastewater entering the co-composting

[24] Summary of Ecuadorian palm oil sector EIAs en Annex 3

	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 PoA, 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. The CME has selected the BOD option.[25]

The formula is thus revised to reflect the above observations:

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

(Equation 2)

Where:

$BOD_{\inf low,y}$	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)
$PE_{y,transp}$	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)

[25] 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 CPAs under this PoA, not estimated based on COD measurements. Based on the availability of historical data, CPAs might carry out the ex-ante estimation of emission reductions based on COD data and the COD emission factor. The use of such assumptions in the ex-ante estimation will not affect BOD measurements nor resultant emission reductions in the monitoring plan.

$PE_{y,comp}$	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 E.3, the CPAs will 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 PoA uses the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" v01, as required by 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 PoA uses the conservative default value of 1.3 tCO_2/MWh. For the system losses, this PoA uses the conservative default value of 20% as per the tool[26]. These parameters are thus fixed for the crediting period and do not need to be monitored.[27]

Project Fossil Fuel Consumption

The only fossil fuel to be consumed in this PoA 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)

[26] Part 27 of AMS III.F v10.0 suggests a default value of 10% for grid losses. This PoA has chosen the larger, more conservative value of 20% from the cited tool instead of this lower value in the approved methodology.

[27] The default emission factor value applies to grid connection (option A2), off-grid generation (option B2) or onsite generation (scenario C.III). Although the cited tool calls for both of these variables to be monitored, since this PoA selects to use the conservative default values, the parameters are considered as fixed.

i	Are the fuel types combusted in process *j* during the year *y*
j	Are the different processes involved in the project activity

This PoA has only one process: composting. The index *j* can thus be ignored. This PoA 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 PoA 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 PoA 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 PoA 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[28]:

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

(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 used in equation 2.

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:

Data / Parameter:	$\eta_{BOD,BL}$
Data unit:	-
Description:	BOD removal efficiency of the baseline treatment system
Source of data used:	As per AMS III.H version 16.0 part 26-28

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

Value applied:	to be determined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	Eligibility criteria No. 21 assures the availability of data to correctly calculate the value of this parameter as per AMS III.H v16.0
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:	to be determined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	The default value depends on the depth of the baseline WWTP lagoons as specified in the data required by eligibility criteria No. 7 or 8.
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 description of measurement methods and procedures actually applied :	Default value in methodology, based on the IPCC default value. This PoA has chosen to measure BOD directly, not COD, as per the option provided in part 20 of AMS III.H version 16.0.
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 :	Conservative default value as per tool, applicable to either grid power or self-generation.
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 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 :	Default value in methodology, based on the IPCC default value. Wet weight basis
Any comment:	Waste quantities and waste characteristics will be measured and reported on a wet basis

Data / Parameter:	**$B_{0,ww,runoff}$**
Data unit:	kg CH_4/kg COD
Description:	Methane producing capacity of the runoff water
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:	The subscripts for this variable have been modified to avoid confusion with the parameter $B_{o,ww}$ introduced in AMS III.H v16.0

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:	to be determined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of this parameter depends on the (maximum) expected operating depth of the lagoon to treat runoff water that is not recycled to the compost plant. The following approach (conservative since it ignores both recycling and evaporation) could be used to calculate this depth: $d_{runoff} = d_{lagoon} * \frac{A_{compost} * R * RT}{1000 * 365 * V_{lagoon}}$ Where: d_{runoff} Operating depth of lagoon treating runoff water (m) d_{lagoon} Design depth of lagoon (m) $A_{compost}$ Compost plant surface area (m^2) R Annual rainfall (mm) RT Retention time (days). A handbook value of 23 days can be used (CENIPALMA, technical bulletin No. 11) V_{lagoon} Volume of lagoon (m^3)
Any comment:	The subscripts for this variable have been modified to avoid confusion with the parameter $MCF_{ww,treatment}$ introduced in AMS III.H v16.0

Data / Parameter:	**UF_b**
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:	

E.7. Application of the monitoring methodology and description of the monitoring plan:

D.7.1. Data and parameters to be monitored by each SSC-CPA:

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 applied for the purpose of calculating expected emission reductions in section B.5	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 environmental ministry 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 applied for the purpose of calculating expected emission reductions in section B.5	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:	**$W_{j,y}$**
Data unit:	Tons
Description:	Amount of organic waste type *j* composted in year *y*, including j = compost

	produced.	
Source of data to be used:	Onsite weigh scale	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	to be determined for each CPA	
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous
	Equipment	Vehicle weigh scale
	Calibration	Onsite calibration and certification annually
	Accuracy	High
	Responsibility	Operators
QA/QC procedures to be applied:	EFB weight will be tracked against Fresh Fruit Bunch (FFB). Compost production per unit EFB will be tracked monthly as well.	
Any comment:	not defined in equations but necessary for monitoring	

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 applied for the purpose of calculating expected emission reductions in section B.5	to be determined for each CPA	
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous monitoring; periodic recordings
	Equipment	Flow meter with totalizer
	Calibration	Offsite calibration yearly
	Accuracy	High
	Responsibility	to be determined for each CPA
QA/QC procedures to be applied:	POME volume will be tracked against Fresh Fruit Bunch (FFB) for each CPA.	
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 used:	Offsite laboratory
Value of data applied for the purpose of	to be determined for each CPA

calculating expected emission reductions in section B.5	Solely for the purpose of the ex-ante emission reduction calculation, not for the monitoring plan, CPAs that do not have historic BOD data could carry out the ex-ante calculation in COD, with the corresponding emission factor.	
Description of measurement methods and procedures to be applied:	Method	Grab sampling and laboratory analysis
	Frequency	to be determined for each CPA via a sampling plan shown in Annex A4.2 in order to achieve a precision of ±10% at a 90% confidence interval
	Equipment	External laboratory accredited nationally for environmental control
	Calibration	As per laboratory protocol for BOD measurement
	Accuracy	High
	Responsibility	to be determined for each CPA
QA/QC procedures to be applied:	As per laboratory protocol for BOD measurement	
Any comment:	Sampling plan to be prepared for each CPA according to the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" v03.0 is shown in Annex A4.2. This PoA 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 applied for the purpose of calculating expected emission reductions in section B.5	to de determined for each CPA	
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous monitoring; periodic recordings
	Equipment	Power meter with totalizer
	Calibration	Offsite calibration every three years
	Accuracy	High
	Responsibility	to be determined for each CPA
QA/QC procedures to be applied:	Electricity consumption will be tracked against compost production	
Any comment:		

Data / Parameter:	**$FC_{Diesel,y}$**
Data unit:	kl
Description:	Consumption of diesel fuel from project equipment in the year y
Source of data to be used:	Onsite fuel pump

Value of data applied for the purpose of calculating expected emission reductions in section B.5	to be determined for each CPA	
Description of measurement methods and procedures to be applied:	Method	Direct measurement of fuelling of project activity equipment
	Frequency	Continuous
	Equipment	Onsite fuel pump
	Calibration	Annually
	Accuracy	High
	Responsibility	Operators
QA/QC procedures to be applied:	All onsite diesel consumption is measured and assigned to operational cost centres. This data can be cross-checked through accounting records.	
Any comment:	CPAs might install diesel tanks at the compost plants. If so, the filling of this tank will be dispatched by the onsite fuel pump.	

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 applied for the purpose of calculating expected emission reductions in section B.5	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 purchases of commercial liquid fuels, only volumes. 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 applied for the purpose of calculating expected	0.0748 (at validation)

emission reductions in section B.5	
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 W) Onsite oxygen sampling and analysis	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	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 the sampling plan, Annex A4.1
	Equipment	Portable oxygen meter with a 1m lance
	Calibration	Self-calibrating oxygen probe (zero and full-scale)
	Accuracy	High
	Responsibility	Compost plant operators
QA/QC procedures to be applied:	Measurement to be included within the CPAs Compost Quality Control Program	
Any comment:	Sampling plan according to the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" v03.0 is shown in Annex A4.1 This variable is determined by multiplying the total volume of waste to be composted (W) 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 applied for the purpose of	to be determined for each CPA based on compost plant area and expected rainfall, as per part 19 of AMS III.F v10.0

calculating expected emission reductions in section B.5		
Description of measurement methods and procedures to be applied:	Method	Direct measurement
	Frequency	Continuous monitoring; periodic recordings
	Equipment	Flow meter with totalizer
	Calibration	Offsite calibration every three years
	Accuracy	High
	Responsibility	to be determined for each CPA
QA/QC procedures to be applied:		
Any comment:		

Data / Parameter:	**$COD_{y,ww,runoff}$**	
Data unit:	tonnes/m^3	
Description:	Chemical oxygen demand of the composting facility's runoff water in the year *y*	
Source of data to be used:	Offsite laboratory	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.001 (only to be used for the ex-ante emission reduction calculation, based on handbook value for domestic wastewater as per part 19 of AMS III.F v10.0[29])	
Description of measurement methods and procedures to be applied:	Method	Grab sampling and laboratory analysis
	Frequency	to be determined for each CPA via a sampling plan shown in Annex A4.2 in order to achieve a precision of ±10% at a 90% confidence interval
	Equipment	External laboratory accredited nationally for environmental control
	Calibration	As per laboratory protocol for COD measurement
	Accuracy	High
	Responsibility	to be determined for each CPA
QA/QC procedures to be applied:	As per laboratory protocol for COD measurement	
Any comment:	Sampling plan to be prepared for each CPA according to the "Standard for Sampling and Surveys for CDM Project Activities and Programme of Activities" v03.0 is shown in Annex A4.2.	

Data / Parameter:	**Compost Quality Control Programme**
Data unit:	- -
Description:	The operation of the co-composting facilities will be documented in a quality control programme, 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	Record keeping of onsite measurements as per the quality management system.

[29] Davis, Mackenzie, L. Water and Wastewater Engineering – Design Principals and Practice. McGraw-Hill. 2010

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	- -
Description of measurement methods and procedures to be applied:	These technical specifications are subject to modification, based on the commitment to continuous improvement.
QA/QC procedures to be applied:	This is a QC procedure.
Any comment:	Draft sample initial specifications in Annex A4.3

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 applied for the purpose of calculating expected emission reductions in section B.5	- -
Description of measurement methods and procedures to be applied:	Dispatch of compost will be measured on the mill's truck scale (please see variable $W_{j,y}$ for the monitoring of compost produced). 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 on a "representative sample of user sites" (as per part 25 of AMS III.F v10.0) to document the adequate soil application of compost.
QA/QC procedures to be applied:	Compost yields (as a percentage of EFB) will be tracked monthly
Any comment:	

Data / Parameter:	**Compost Price**
Data unit:	- -
Description:	The price of compost will be monitored
Source of data to be used:	Accounting records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable since this parameter is not used to determine ex-ante emission reductions.
Description of measurement methods	Eligibility criteria No. 9 requires that compost be sold at cost to the plantations. The CME publishes guidelines to calculate the compost selling price. The

and procedures to be applied:	financial auditor of each CPA will provide assurance that this cost is correctly calculated.
QA/QC procedures to be applied:	As per financial auditing procedures.
Any comment:	

E.7.2. Description of the monitoring plan for a SSC-CPA:

The monitoring plan for a SSC-CPA will be designed to integrate the measurement and record keeping of the data and parameters listed above within each CPA's internal systems, such as plant information management system or quality management system.

Classification of Data and Parameters

Type of Monitoring	***Data and Parameters***
Continuous automated monitoring with monthly register of totalized values	$Q_{ww,y}$ EC_y $Q_{y,ww,runoff}$
Continuous monitoring by lots with manual register	$W_{j,y}$ FC_{Diesel}
Monthly monitoring onsite with manual register	$Q_{y,Portion}$
Periodic monitoring offsite	$BOD_{inflow,y}$ $COD_{y,ww,runoff}$
Annual photographic monitoring	Adequate Soil Application of Compost
Annual monitoring of CDM variables	$MD_{y,reg}$ GWP_CH4 NCV_{Diesel} $EF_{CO2,Diesel}$
Annual financial audit	Compost Price
Integrated QA/QC	Compost Quality Control Program

Monitoring Equipment

Monitoring equipment will be inventoried and included within registry of measurement equipment items at each CPA.

Maintenance and calibration requirements for monitoring equipment will be included within the schedules 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.

Onsite monitoring equipment items for each CPA are:

- Truck scale
- Diesel fuel pump
- Wastewater flow meter
- Compost plant runoff water flow meter
- Compost plant power meter
- Portable, self-calibrating oxygen probe with 1m lance
- Measurement equipment for the Compost Quality Control Programme (portable temperature and humidity probes)

Operational and Management Structure

The operational and management structure for monitoring emission reductions will be designed specifically for each CPA, considering the host palm oil mill's organizational structure and internal management systems.

CME will carry out monitoring of CDM variables and prepare the monitoring reports. CME will also review the monitoring data compiled by each CPA.

Data Collection and Archiving

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

Additional Monitoring Considerations

Erroneous or missing measurements

Provisions for erroneous or missing measurements will only apply to those parameters that are monitored continuously ($W_{j,y}$, $Q_{ww,y}$, 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 PoA 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 a host palm oil 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 a compost plant is abandoned due to an emergency condition, a measurement campaign to determine oxygen content (as per parameter $Q_{y,Portion}$) will be carried out within three working days after having achieved process normalcy.

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

14/12/2011

Entity:

Gestora de Programa Palma, S.L.
(Contact details in Annex I)

This entity is CME and Project Participant.

Responsible person:

Laurence W. (Larry) Philp

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	Gestora de Programa Marco Palma, S.L.
Street/P.O.Box:	Costanilla de los Ángeles, 13
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Represented by:	
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First Name:	Laurence
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Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in setting up this PoA.

Annex 3

BASELINE INFORMATION

Summary data available from published EIAs, Ecuadorian Palm Oil Sector

Plant	*Address*	*Province*	*Town*	*EFB Disposal*	*WWTP*
Agroparaiso	Vía Los Angles Km. 16 - Via a Quevedo	Santo Domingo de los Tsáchilas	Santo Domingo	Organic Landfill	WWT Lagoons
Aiquisa	Km. 3 Vía Santo Domingo Quinindé	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Danayma	Km. 54 Vía Santo Domingo - Quinindé	Esmeraldas	Quinindé	Mulched	WWT Lagoons
La Joya	Km. 2 1/2 Las Villagas - Plan Piloto	Esmeraldas	La Concordia	Piled then mulched	WWT Lagoons
La Sexta	Vía Las Maravillas Rct. Simón Bolívar	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Palcien	Km. 1/2 Vía Malimpia, Sector La Gorgona	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Palduana	Km. 7 1/2 Vía las Golondrinas	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Pexa	Km. 47 Vía Quinindé - La Concordia	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Río Manso / San Carlos	Km. 41 Santo Domingo-Quevedo	Los Ríos	Buena Fe	Mulched	WWT Lagoons
Teobroma	Km. 34 Vía Santo Domingo La Concordia	Esmeraldas	La Concordia	Piled then mulched	WWT Lagoons
Aceitplacer	Km, 44 Vía Santo Domingo - Quinindé	Esmeraldas	La Concordia	Piled then mulched	WWT Lagoons
Energy & Palma	Calle Sucre y Rocafuerte 2-41	Esmeraldas	San Lorenzo	Mulched	WWT Lagoons

Plant	*Address*	*Province*	*Town*	*EFB Disposal*	*WWTP*
Epacem1	Km. 7 1/2 Vía Santo Domingo - Quinindé	Santo Domingo de los Tsáchilas	Santo Domingo	Piled then mulched	WWT Lagoons
Epacem2	Km. 26 Vía Santo Domingo Quevedo	Santo Domingo	Santo Domingo	Piled then mulched	WWT Lagoons
Epacem3 El Rocio	Vía 10 de Agosto	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Palcien Viche Fina	Sector Km. 2 Vía Viche - Esmeraldas	Esmeraldas	Esmeraldas	Mulched	WWT Lagoons
Provasa	Km. 6 del Recinto El Sade	Esmeraldas	Quinindé	Piled then mulched	WWT Lagoons
Río Santiago	Av. De los Granados E14-947 y Azucenas Quito	Esmeraldas	Eloy Alfaro	Mulched	WWT Lagoons
San Daniel	Km. 42 Vía Monterrey	Esmeraldas	La Concordia	Piled then mulched	WWT Lagoons
Tarragona Dar1	Km. 29 Vía Santo Domingo - Quinindé	Santo Domingo	Santo Domingo	Piled then mulched	WWT Lagoons

Source: information compiled from each of the EIAs listed in the table.

Annex 4

MONITORING INFORMATION

A4.1 Sampling Plan for Compost Pile Oxygen Content

A4.1.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 A4.3), 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.

A4.1.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.

A4.2 Sampling Plan for Biological and Chemical Oxygen Demand

A4.2.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 $(SD/mean)^2$.

Parameter	***Unit***	***Source / Comments***
Sample mean	g/l	To be identified for each CPA based on historical plant records or sectoral data sources
Sample variance	g^2/l^2	

Based on the above data, V and n are calculated for each CPA.

If 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.

A4.2.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 each CPA's 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%.

A4.2.C Implementation

Implementation plan

Grab sampling will be carried out by qualified technicians from each CPA`s 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 PoA 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%.

A4.3 Sample Guidelines for Compost Quality Control Programme

Process step	Process description	Parameter to monitor	Specification limit	Recording Frequency	Trigger point	Inspection method	Routine procedure
Windrow formation	Reception of EFB	Type of feedstock	Only authorized*	Daily	Non-authorized	Visual	Identify foreign feedstock and discard
	Configuration of windrows	Heap height (m)	to be determined*	each heap	lower bound*	Visual	Add more material
					upper bound*	Visual	Remove excess material
		Heap width (m)	to be determined*	each heap	lower bound*	Visual	Add more material
					upper bound*	Visual	Remove excess material
Active phase	Spraying POME on windrows	Moisture	50-65%	Daily	>65%	Hygrometer	Cease POME spraying
				Daily	<50%	Hygrometer	Increase POME spraying
	Regular turning of windrows	Temperature (°C)	45-65°C	Daily	>65°C	Thermometer	Turn windrow to assure aerobic conditions
		Oxygen	10-15%	Weekly	<10%	Portable Oxygen probe	Turn windrow to assure aerobic conditions
Curing phase	Adequate curing	Moisture	30-40%	Weekly	>40%	Hygrometer	Extend curing period
		Temperature (°C)	Ambient* +10°C	Weekly	upper bound*	Thermometer	Extend curing period
		C:N ratio	15:1 to 40:1	6 / year	>40:1	Laboratory	Change mixture
				6 / year	<15:1	Laboratory	Change mixture

* Quality control variables to be established for each CPA. Values shown in this table are indicative but not binding for individual CPAs.