Monitoring report form
(Version 05.1)

Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.

MONITORING REPORT		
Title of the project activity	Biogas recovery from wastewater treatment in PT. Umbul Mas Wisesa Palm Oil Mill	
UNFCCC reference number of the project activity	9197	
Version number of the monitoring report	01	
Completion date of the monitoring report	31/05/2016	
Monitoring period number and duration of this monitoring period	Monitoring period number-01 Monitoring period-16/04/2015 to 30/04/2016	
Project participant(s)	PT Umbul Mas Wisesa	
Host Party	Indonesia	
Sectoral scope(s)	Sectoral scope 13	
Selected methodology(ies)	Baseline and monitoring methodology applied: AMS-III.H "Methane recovery in wastewater treatment" (version 16)	
Selected standardized baseline(s)	Not applicable	
Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD	60483 tCO_2e	
Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	0 tCO_2e	23537 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

>>

The proposed small-scale project activity is the implementation of a sequential stage of anaerobic wastewater treatment system with biogas recovery in a palm oil mill. Both, the palm oil mill as well as the wastewater treatment system with biogas recovery is Greenfield projects. The palm oil mill is located at South Labuhan Batu, North Sumatra, Indonesia. The designed production capacity of the mill is 65 tonnes/hr of fresh fruit bunch ("FFB"). The discharged POME, rich in organic content with Chemical Oxygen Demand (COD) value approximately 65,000 mg/l.

Degradation of organic content in the POME results in the generation of biogas (i.e. methane), which will be emitted into the atmosphere if not recovered. The purpose of the proposed project activity is to treat the discharged POME in an anaerobic digester and to recover the biogas, which would have otherwise been emitted to the atmosphere. The recovered biogas is being combusted together with biomass in a boiler in the palm oil mill and in emergency situation excess biogas being flared. The end use of biogas led to saving of biomass, which would have been used in boiler by the project activity, resulting the saved biomass available to be used by other project activity for steam/power generation displacing fossil fuel, however, the emission reduction due to end use of biogas will not be considered under the proposed project activity.

The construction for project activity started in May 2013, commissioning started in April 2014 and project become operational on 01/04/2015. The project was operational during current monitoring period i.e. from 16/04/2015 to 30/04/2016 the total quantity of POME treated during this verification period is 90691 m^3, which results to a net emission reduction of **23537** tCO_2e.

A.2. Location of project activity

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The Project Activity site located at South Labuhan Batu Regency, Kampung Rakyat sub-district, North Sumatra Province, Sumatra Island, Indonesia. The GPS coordinates of the project activity is as follows –

Latitude: 2°12' 50.55"N
Longitude: 100°16' 15.14" E

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether the Party involved wishes to be considered as project participant (yes/no)
Indonesia (host)	Private entity- PT Umbul Mas Wisesa	No

A.4. Reference of applied methodology and standardized baseline

>>

The baseline and monitoring of this project activity is based on the following approved methodology, guidelines and tools:

***Methodology: AMS-III.H (version 16)**: "Methane recovery in wastewater treatment"*

Tools:

- *General guidelines for SSC CDM methodologies (Version 20.0);*
- *Clean development mechanism project standard (Version 07.0);*
- *Guidelines on the Demonstration of Additionality of Small-Scale Project Activities (Version 09.0);*
- *Guidelines for completing the project design document form for small-scale CDM project activities (Version 01.1);*
- *Project emissions from flaring (Version 02.0.0);*
- *Sampling and surveys for CDM project activities and programme of activities (Version 04.1);*
- *Tool to calculate baseline, project and-or leakage emissions from electricity consumption (Version 01);*
- *Tool to determine the mass flow of a greenhouse gas in a gaseous stream (Version 02.0.0)*

A.5. Crediting period of project activity

>>
This project activity has considered fixed crediting period of 10 years. The start date of the crediting period is from 16/04/2015 to 15/04/2025.

A.6. Contact information of responsible persons/entities

>>
PT Umbul Mas Wisesa, also a project participant; please see the contact details in Appendix-I.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>>The technology applied for the project activity is an anaerobic digester system with methane recovery for treatment of POME generated from the palm oil milling operations. The process includes

Up Stream Pre Treatment Systems

The raw wastewater from the process is taken to the effluent treatment plant through closed pipe. Effluent enters into the screen chamber for the removal of floating matter and then enters into the Oil &Grease trap.

Equalization Tank:
The effluent from oil & grease trap enters into the equalization tank for equalization and surge control. Effluent from the equalization tank then pumped into buffer tank through Plate Heat Exchanger (PHE).

Plate Heat Exchanger (PHE):
The raw wastewater from Equalization Tank (EQT) pumped to plate heat exchanger to reduce the temperature.

Dissolve Air Floatation System (DAF)
Effluent from the Plate Heat Exchanger enters in to the Dissolved Air Flotation system. This system is used to remove residual emulsified oil and suspended solids from the effluent to the maximum extent. This DAF is provided as a backup. It is used only when COD of inlet POME is above designed value.

Primary Clarifier:
The effluent from Dissolved Air Flotation then enters into the primary clarifier. The clarifier is a hopper bottom circular tank with centrally driven clarifier mechanism to remove excess solids. It is being used mainly during trouble shooting of process.
Buffer Tank

In buffer tank the complex organics in the wastewater is subjected to hydrolysis. The hydrolyzed effluent pumped from the buffer tank for anaerobic treatment in the reactor.

ANAEROBIC CSTR REACTOR

It is non-media, Continuously Stirrer Tank Reactor. It is mesophillic reactor i.e. it operates best in temp range of 36 – 39 ^{O}C. In reactor the raw waste is introduced from top of the reactor. The recycled sludge is also introduced from the top of the reactor. This mixed liquor travels downward through the central shaft. In this central shaft, agitator provides adequate mixing of raw waste and recycled sludge. From central shaft liquor enters reactor near bottom of tank.

The solids are separated from the outlet of reactor in Lamella Clarifier and returned to the system by recirculation pumps. This recirculation of settled solids helps to maintain adequate population of active bacteria inside reactor.

The biogas produced by anaerobic digestion inside the reactor is collected from reactor roof. Biogas is then transferred to floating type gas holder. Biogas is then conveyed to blower for further utilization in boiler or biogas engines.

Down Stream Treatment systems

Conventional Aeration Tank:

The overflow from lamella clarifier enters into conventional aeration tank. In Conventional Aeration Tank microorganisms degrade soluble organics aerobically.

Secondary Clarifier-A:

The mixed liquor from Conventional Aeration Tank enters the central well of clarifier–A for separation of sludge and liquid. The clarifier is a hopper bottom circular tank with centrally driven clarifier mechanism.

Extended Aeration Tank:

The overflow of clarifier-A enters into Extended Aeration Tank. In Extended Aeration Tank microorganisms degrade soluble organics aerobically.

Secondary Clarifier-B:

The mixed liquor from Extended Aeration Tank enters the central well of clarifier-B for separation of sludge and liquid. The clarifier is a hopper bottom circular tank with centrally driven clarifier mechanism.

Chlorine Contact Tank

The treated effluent is further subjected to chlorination for disinfection.

De-Chlorine Tank (DCT)

The treated wastewater further subjected to de-chlorination. Sodium Meta Bi Sulphite solution is added to treated wastewater.

Multi Grade Filter (MGF)

De-chlorinated effluent then be pumped to Multi Grade Filter for removal of suspended solids.

Activated Carbon Filter (ACF)

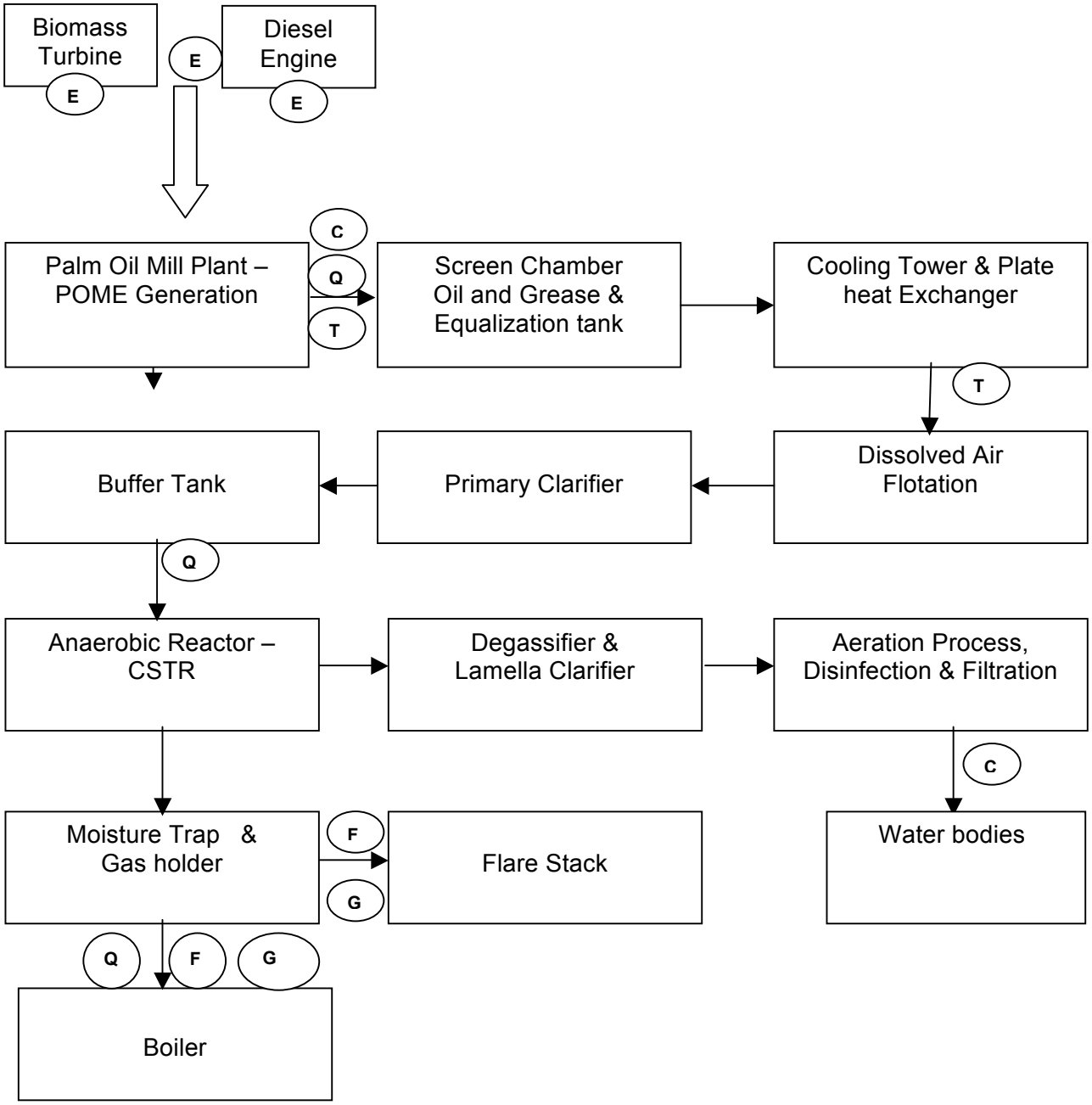
Effluent will then be pumped from Multi Grade Filter to activated carbon filter for removal of suspended solids, color, odor etc.

The clarified overflow POME from the clarifier will be further treated in the downstream activities. The final treated POME will be discharged to nearby river.

The specification of the anaerobic digester to be used in the project activity is as follows:

Model	: LESAR reactor
Digester type	: Continuously Stirrer Tank Reactor
Volume	: 8,495 m^3
Hydraulic retention time	: 11 days (=8,495m^3 / 780 m^3/day)
Operating temperature	: 36-39^oC
Volume of biogas	: 0.5 ± 5% m^3/kg COD removed
Expected biogas CH_4 composition	: 60% methane
Design COD removal efficiency	: 85 %
Operational lifetime	: 20 years

The overall process flow diagram applied in the proposed project are shown in the figure below –



Process Flow Diagram

The recovered biogas from the project activity is combusted together with biomass in a boiler. In case there is any excess of biogas, is flared in an open flare system.

The project activity was shut down for 78 days during current monitoring period due to various reasons. Except above the project activity was operational with scheduled operation and maintenance. The construction for project activity started in May 2013, commissioning started in April 2014 and the project activity has been commissioned on 01/04/2015.

B.2. Post-registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

>>
No temporary deviation taken place from registered monitoring plan or applied approved methodology during current monitoring period.

B.2.2. Corrections

>>
No corrections are applied in the registered PDD in this monitoring period.

B.2.3. Changes to start date of crediting period

>>
No changes to start date of crediting period

B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>
There is no inclusion of monitoring plan to registered PDD.

B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
There are no permanent changes from registered monitoring plan during current monitoring period.

B.2.6. Changes to project design of registered project activity

>>
There is no change in project design of registered project activity during current monitoring period.

B.2.7. Types of changes specific to afforestation or reforestation project activity

>>

Not applicable as the project activity is not an afforestation or reforestation project activity.

SECTION C. Description of monitoring system

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The PP has assigned operational team of the palm oil mill for data monitoring, archiving and analyzing and is reported to the plant's management team.

There is an operational and management team, which is responsible to operate and maintain the wastewater treatment system and implement the monitoring plan.

The team is responsible for daily monitoring of the processes in accordance to the quality assurance and control of each parameter as per the monitoring plan. In addition, a technician responsible in recording the monitored data and report any abnormalities to plant manager on daily basis. The aggregated monitored and recorded data will be stored electronically and in hard copy format up to 2 years after the end of crediting period or the last issuance of CERs, whichever is later. The monitored and recorded data is used and presented to DOE during CERs verification. The plant manager has reviewed the work performed by the technician and making final reporting to the management of the PP.

The roles and responsibilities performed by the team members are as below:

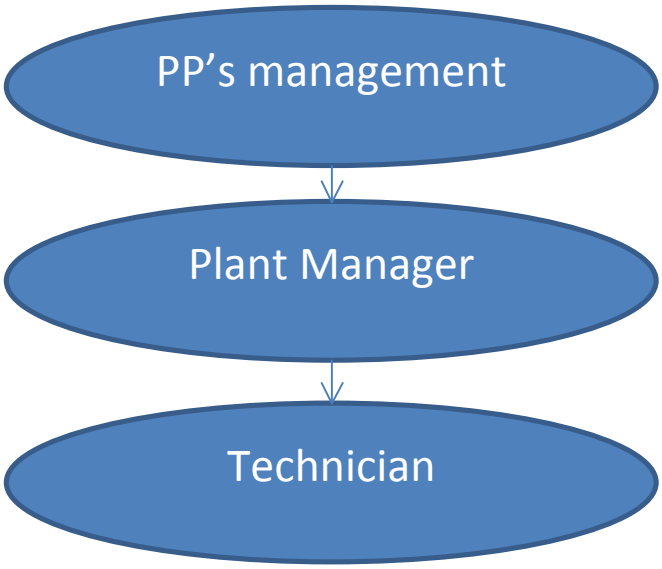

Figure: Organizational Structure

Role	Responsibility description
Technician	• *Data collection* ○ Collect the data on the various monitoring parameters as per the monitoring plan. ○ Report to the plant manager if there any abnormalities • *Data archiving* ○ Well-defined protocols and routine procedures, with good, professional data entry, extraction and reporting will be

Role	Responsibility description
	encouraged to maximize transparency of data archiving • *Data aggregation and emission reduction calculations* o Data for various parameters aggregated and used in emission reduction calculations. • *Verification* o Coordinate with the DOE during verification.
Plant Manager	• Review and confirm the raw data collected, aggregated and emission reduction calculations done by the technician. • Assist the technician during verification. • Responsible for reporting the following to the management: • Estimated emission reductions during the monitoring period • Outcome of the verification and status of issuance of CERs

Quality assurance and quality control
Calibration has been carried out in accordance with the equipment manufacturer's recommendation as applicable depending upon the nature of the measurement equipment. There are measurement equipments, which need not be recalibrated during their entire life span. PP will take responsibility for the quality assurance and quality control for recording, maintaining and archiving all the data by appointing consultants and/or technical support team to carry out the system analysis, equipment calibration and overall maintenance on a regular basis throughout the crediting period. PP has provided necessary training on data monitoring and recording to all the staff personnel involved in the monitoring process, in order to improve the efficiency of their work.

Emergency procedure
PP has implement an Emergency Procedure in the plant, for which a detailed manual being developed. The manual contains instructions on how to handle an emergency situation in the plant, and measures to be taken to ensure that there is no unintended methane leakage from the system. All the plant operators have been familiarized on the procedure.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data/parameter:	**$MCF_{ww,treatment,BL,i}$**
Unit	Fraction
Description	Methane correction factor for baseline wastewater treatment system
Source of data	Table III.H.1 in AMS-III.H (version 16)
Value(s) applied)	0.80
Choice of data or measurement methods and procedures	The default value for anaerobic deep lagoons with depth of more than 2 m is specified in AMS-III.H
Purpose of data	Calculation of baseline emission
Additional comments	None

Data/parameter:	**$B_{o,ww}$**
Unit	kg CH_4/kgCOD
Description	Methane producing capacity of the wastewater

Source of data	Paragraph 20 of AMS-III.H (version 16)
Value(s) applied)	0.25
Choice of data or measurement methods and procedures	IPCC value, as per AMS-III.H (version 16) paragraph 20
Purpose of data	Calculations of baseline and project emissions
Additional comments	None

Data/parameter:	**UF_{BL}**
Unit	Fraction
Description	Model correction uncertainty factor to account for model uncertainties
Source of data	Paragraph 22 of AMS-III.H (version 16)
Value(s) applied)	0.89
Choice of data or measurement methods and procedures	As per paragraph 22 of AMS-III.H (version 16)
Purpose of data	Calculations of baseline emissions
Additional comments	None

Data / Parameter	**GWP_{CH4}**
Unit	-------
Description	Global warming potential of methane
Source of data	IPCC value as per paragraph 20 of AMS-III.H (version 16)
Value(s) applied	25
Choice of data Or measurement methods and procedures	IPCC default for second commitment period
Purpose of data	Calculations of baseline and project emissions
Additional comment	None

Data / Parameter	**$\eta_{COD,BL,i}$**
Unit	%
Description	COD removal efficiency of the baseline treatment system i
Source of data	The value as per manufacturer specification
Value(s) applied	85
Choice of data Or measurement methods and procedures	The data has been determined (please refer to Appendix-4) in line with the requirements of paragraph 28 (2) (b) of the baseline and monitoring methodology AMS-III.H (version 16).
Purpose of data	Calculations of baseline emissions
Additional comment	None

Data / Parameter	**$MCF_{ww,treatment\ PJ,k}$**
Unit	Fraction
Description	Methane correction factor for project wastewater treatment system k
Source of data	Table III.H.1 in AMS-III.H (version 16)
Value(s) applied	0.8

Choice of data Or measurement methods and procedures	The project activity wastewater treatment system is an anaerobic digester
Purpose of data	Calculations of project emissions
Additional comment	None

Data / Parameter	**UF_{PJ}**
Unit	Fraction
Description	Model correction to account for model uncertainties
Source of data	Paragraph 30(a) Eq 11 of AMS-III.H (version 16)
Value(s) applied	1.12
Choice of data Or measurement methods and procedures	As per paragraph 30 of AMS-III.H (version 16)
Purpose of data	Calculations of project emissions
Additional comment	None

Data / Parameter	**$\eta_{COD,PJ,j}$**
Unit	%
Description	COD removal efficiency of the project treatment system j.
Source of data	The COD removal efficiency is obtained from the supplier of the anaerobic digester.
Value(s) applied	85%
Choice of data Or measurement methods and procedures	The value is used from manufacturer specification.
Purpose of data	Calculations of Project emissions
Additional comment	None

Data / Parameter	**CFE_{ww}**
Unit	-
Description	Capture efficiency of the biogas recovery equipment in the wastewater treatment systems
Source of data	Default value as per paragraph 30(a) Eq 10 of AMS-III.H version 16
Value(s) applied	0.9
Choice of data Or measurement methods and procedures	In line with AMS-III.H version 16 Para 30(a)
Purpose of data	Calculations of Project emissions
Additional comment	None

Data / Parameter	MCFww,PJ,discharge
Unit	-
Description	Methane correction factor based on the discharge pathway of the wastewater in the project scenario (e.g. into sea, river or lake)
Source of data	Table III.H.1 in AMS-III.H (version 16)
Value(s) applied	0.1
Choice of data Or measurement methods and procedures	The treated wastewater in the project scenario will be discharged to nearby river.
Purpose of data	Calculations of baseline emissions
Additional comment	None

Data / Parameter	$EF_{EL,j,y}$
Unit	tCO2/MWh
Description	Emission factor for electricity generation for source j in year y, where j is the source of electricity consumption in the project
Source of data	Default value under option B2 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (EB 39, Annex 7)
Value(s) applied	1.3
Choice of data Or measurement methods and procedures	In line with AMS-III.H version 16 Para 29
Purpose of data	Calculations of Project emissions
Additional comment	None

Data / Parameter	Hflare
Unit	-
Description	Flare efficiency
Source of data	Default value for open flaring as per "Project emissions from flaring"
Value(s) applied	0.5, if flare is detected in a minute. 0, otherwise
Choice of data Or measurement methods and procedures	The flaring system used in the project activity is open flaring. Default value of 50% flare efficiency can be used if the flare is detected in a minute . Otherwise, the default efficiency to be considered as 0%.
Purpose of data	Calculation of project emissions
Additional comment	None

Data / Parameter	Ru
Unit	(Pa.m3/kmol.K)
Description	Universal ideal gases constant
Source of data	Tools to determine the mass flow of a greenhouse gas in a gaseous stream
Value(s) applied	8,314
Choice of data Or measurement methods and procedures	Default value
Purpose of data	Calculation of project emissions
Additional comment	None

Data / Parameter	Mmi
Unit	kg/kmol
Description	Molecular mass of greenhouse gas i
Source of data	Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0)
Value(s) applied	

Compound Structure	Molecular mass (kg / kmol)
Methane CH4	16.04

Choice of data Or measurement methods and procedures	The default value from Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0).
Purpose of data	Calculation of project emission
Additional comment	None

D.2. Data and parameters monitored

Data/parameter:	**$Q_{ww,i,y}$**
Unit	m^3
Description	Monthly volume of untreated wastewater entering (inflow) the anaerobic digester in project activity
Measured/calculated/default	Measured
Source of data	Measurements undertaken using flow meter.
Value(s) of monitored parameter	90691
Monitoring equipment	Measurements are undertaken by using flow meter at inlet of the anaerobic digester.
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement, Monthly recording
Calculation method (if applicable):	Not applicable
QA/QC procedures:	The flowt is monitored continuously and based on hourly reading aggregated daily and monthly values. Calibration of the flow meters is conducted as specified by manufacturer i.e. once in 3 years.
Purpose of data:	Calculation of baseline emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**$COD_{untreated,i,y}$ or $COD_{inflow,i,y}$**
Unit	$tCOD/m^3$
Description	Chemical Oxygen Demand of the wastewater entering the Anaerobic Digester
Measured/calculated/default	Calculated
Source of data	Representative Sampling by PP
Value(s) of monitored parameter	0.86680
Monitoring equipment	The measurement of COD is conducted as per standard practice. The COD measured through representative sampling on daily basis. The value has been cross-checked periodically through an accredited laboratory.
Measuring/reading/recording frequency:	Daily reading, monthly aggregation
Calculation method (if applicable):	The data is recorded on daily basis and monthly average has been taken for calculation of emission reduction.
QA/QC procedures:	Average value used through sampling with 90/10 confidence/precision level.
Purpose of data:	Calculation of baseline emission

Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**$COD_{ww,treated,y}$**
Unit	$tCOD/m^3$
Description	Chemical oxygen demand of the treated wastewater leaving the anaerobic digester
Measured/calculated/default	Measured
Source of data	Representative Sampling by PP
Value(s) of monitored parameter	0.022743
Monitoring equipment	The measurement of COD is conducted as per standard practice. The COD measured through representative sampling on daily basis. The value has been cross-checked periodically through an accredited laboratory.
Measuring/reading/recording frequency:	Daily reading, monthly aggregation
Calculation method (if applicable):	The data is recorded on daily basis and monthly average has been taken for calculation of emission reduction.
QA/QC procedures:	Average value used through sampling with 90/10 confidence/precision level.
Purpose of data:	Calculation of baseline emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**$COD_{ww,discharge,pj,y}$**
Unit	$tCOD/m^3$
Description	Chemical oxygen demand of the treated wastewater discharged into sea river or lake
Measured/calculated/default	Measured
Source of data	Representative Sampling by PP
Value(s) of monitored parameter	0.00035
Monitoring equipment	The measurement of COD is conducted as per standard practice. The COD measured through representative sampling on daily basis. The value has been cross-checked periodically through an accredited laboratory.
Measuring/reading/recording frequency:	Daily reading, monthly aggregation
Calculation method (if applicable):	The data is recorded on daily basis and monthly average has been taken for calculation of emission reduction.
QA/QC procedures:	Average value used through sampling with 90/10 confidence/precision level.
Purpose of data:	Calculation of project emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**vi,t,db**
Unit	m^3 gas i/m^3 dry gas
Description	Volumetric fraction of greenhouse gas i in a time interval t on a dry basis
Measured/calculated/default	Measured

Source of data	Onsite record
Value(s) of monitored parameter	0.7177
Monitoring equipment	Continuous gas analyser operating in dry-basis. Volumetric flow measurement refer to the actual pressure and temperature
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement, Monthly recording
Calculation method (if applicable):	Not applicable
QA/QC procedures:	Calibration includes zero verification with an inert gas (e.g. N2) and at least one reading verification with a standard gas (single calibration gas or mixture calibration gas). All calibration gases will have a certificate provided by the manufacturer and under their validity period.
Purpose of data:	Calculation of project emissions
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**Vt,db**
Unit	m^3 dry gas/h
Description	Volumetric flow rate of the gaseous stream in time interval t on a dry basis
Measured/calculated/default	Measured
Source of data	Measured on site.
Value(s) of monitored parameter	259
Monitoring equipment	Volumetric flow measurement refers to the actual pressure and temperature.
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement, Monthly recording
Calculation method (if applicable):	Calculated based on the wet basis flow measurement plus water concentration measurement
QA/QC procedures:	Periodic calibration against a primary device provided by an independent accredited laboratory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data:	Calculation of project emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**Flame,m**
Unit	Flame on or Flame off
Description	Flame detection of flare in the minute m
Measured/calculated/default	Measured
Source of data	Flare detection system
Value(s) of monitored parameter	90000
Monitoring equipment	Measure using a fixed installation optical flame detector
Measuring/reading/recording frequency:	Continuous monitoring, reading every minute
Calculation method (if applicable):	Not applicable

QA/QC procedures:	Calibration of the detector conducted according to the manufacturer's specification i.e. once every 3 years.
Purpose of data:	Calculation of project emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**$EC_{PJ,i,y}$**
Unit	MWh/yr
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Measured/calculated/default	Measured
Source of data	Electricity meters
Value(s) of monitored parameter	14.3
Monitoring equipment	Energy meter of accuracy class 0.5s.
Measuring/reading/recording frequency:	Continuous monitoring, Monthly recording
Calculation method (if applicable):	The data will be recorded on a monthly basis from main meter at the site. Based on the recorded data, Joint Meter readings will be issued to the PP on a monthly basis.
QA/QC procedures:	Calibration of the meter is conducted according to the manufacturer's specification i.e. once in a year.
Purpose of data:	Calculation of baseline emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**Tt**
Unit	K
Description	Temperature of the gaseous stream in time interval t (K)
Measured/calculated/default	Measured
Source of data	Temperature meter
Value(s) of monitored parameter	41.85
Monitoring equipment	The temperature is recorded using thermo couple.
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement
Calculation method (if applicable):	Monthly average taken.
QA/QC procedures:	Periodic calibration against a primary device provided by an independent accredited laboratory is mandatory. Calibration and frequency of calibration is according to manufacturer's specifications.
Purpose of data:	Calculation of baseline emission

Additional comments:	Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency). However, if the applicability condition related to the gaseous stream flow temperature being below 60”C is adopted, this parameter must be monitored continuously to assure the applicability condition is met. The data will be archived electronically and kept for minimum of two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data/parameter:	**Pt**
Unit	Pa
Description	Pressure of the gaseous stream in time interval t
Measured/calculated/default	Measured
Source of data	Pressure transmitter
Value(s) of monitored parameter	1470
Monitoring equipment	Pressure transmitter
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement, Monthly recording
Calculation method (if applicable):	Monthly average taken
QA/QC procedures:	Periodic calibration against a primary device must be performed periodically and records of calibration procedures must be kept available as well as the primary device and its calibration certificate. Pressure transducers (either capacitive or resistive) must be calibrated yearly.
Purpose of data:	Calculation of project emission
Additional comments:	Provided all parameters are converted to normal conditions during the monitoring process, this parameter may not be needed except for moisture content determination and therefore it should be metered only when performing such measurements (with same frequency) The data will be archived electronically and kept for minimum of two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data/parameter:	**TDLi,y**
Unit	
Description	Average technical transmission and distribution losses for providing electricity to source j in year y
Measured/calculated/default	Measured
Source of data	Tool to calculate baseline, project and/or leakage emissions from electricity consumption
Value(s) of monitored parameter	0
Monitoring equipment	Not applicable
Measuring/reading/recording frequency:	Not applicable

Calculation method (if applicable):	Measurement is not required as default value of 0 is used for scenario B according to the Tool to calculate baseline, project and/or leakage emissions from electricity consumption.
QA/QC procedures:	Not applicable
Purpose of data:	Calculation of project emission
Additional comments:	The data will be archived electronically and kept for minimum of two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data/parameter:	**$BG_{burnt\ ,\ y}$**
Unit	m3
Description	Biogas volume in year y
Measured/calculated/default	Measured
Source of data	Measurements undertaken using flow meter.
Value(s) of monitored parameter	1971508
Monitoring equipment	Gas flow meter
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement, Monthly recording
Calculation method (if applicable):	In all cases, the amount of biogas recovered, fuelled, flared has been monitored using continuous flow meters. The biogas streams flared and fuelled (or utilized) are monitored separately, the two fractions has been added together to determine the total biogas recovered, without the need to monitor the recovered biogas before the separation. The methane content measurement is carried out close to a location in the system where a biogas flow measurement takes place.
QA/QC procedures:	The flow is monitored continuously and based on hourly reading aggregated daily and monthly values. Calibration of the flow meters is conducted as specified by manufacturer i.e. once in 3 years.
Purpose of data:	Calculation of baseline emission
Additional comments:	Data will be archived for 2 years from the end of the crediting period or the last request for issuance whichever is later.

Data/parameter:	**$\eta_{flare,h}$**
Unit	Percentage
Description	Flare efficiency in hour h based on measurements or default values.
Measured/calculated/default	Measured
Source of data	Based on default value
Value(s) of monitored parameter	0.5
Monitoring equipment	Not applicable
Measuring/reading/recording frequency:	Continuous monitoring, Hourly measurement, Monthly recording
Calculation method (if applicable):	This should include all data and parameters that are required to monitor whether the flare operates within the range of operating conditions according to the manufacturerís specifications including a flame detector in case of open flares.
QA/QC procedures:	NA
Purpose of data:	Calculation of project emission

Additional comments:	The data will be archived electronically and kept for minimum of two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data/parameter:	$S_{final,PJ,final}$
Unit	Tonnes
Description	Amount of dry matter in final sludge
Measured/calculated/default	Measured
Source of data	Onsite measurement
Value(s) of monitored parameter	0
Monitoring equipment	Volume measurement
Measuring/reading/recording frequency:	Average value will be used through sampling with 90/10 confidence/precision level. Calibration of the equipment used will also be conducted as per manufacturer specifications. Cross-check will be performed at least every six months by accredited lab. In case accredited lab is used, the acredition certificate will act as the proof of correct calibration and application of standard by the respective lab.
Calculation method (if applicable):	Measure the total quantity of sludge on a wet basis. The volume (m3) and density or direct weighing may be used to determine the sludge amount (wet basis). Representative samples are taken to determine the moisture content to calculate the total sludge amount on dry basis. If the methane emissions from anaerobic decay of the final sludge are to be neglected because the sludge is controlled combusted, disposed of in a landfill with methane recovery, or used for soil application, then the end-use of the final sludge will be monitored during the crediting period.
QA/QC procedures:	Average value will be used through sampling with 90/10 confidence/precision level.
Purpose of data:	Calculation of project emission
Additional comments:	The data will be archived electronically and kept for minimum of two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

Data/parameter:	$w_{CH4,y}$
Unit	%
Description	Methane content in the biogas in year y.
Measured/calculated/default	Measured
Source of data	Onsite measurement using gas analyser.
Value(s) of monitored parameter	71.77
Monitoring equipment	Gas analyser
Measuring/reading/recording frequency:	Daily mesurement, Monthly recording
Calculation method (if applicable):	The fraction of methane in the gas will be measured with a continuous analyser or, alternatively, with periodical measurements at a 90/10 confidence/precision level by appointed staff of the project owner. It will be measured using equipment that can directly measure methane content in the biogas - the estimation of methane content of biogas based on measurement of other constituents of biogas such as CO2 is not permitted. The methane content measurement shall be carried out close to a location in the system where a biogas flow measurement takes place.

QA/QC procedures:	The measurement will be monitored regularly and the analyser used will be calibrated periodically as per vendor's specifications.
Purpose of data:	Calculation of project emission
Additional comments:	The data will be archived and kept for minimum of two years after the end of the crediting period or the last issuance of CERs for the project activity, whichever occurs later.

D.3. Implementation of sampling plan

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During monitoring period, the COD level will be determined through sampling. Representative sample size will be taken to ensure the 90/10 confidence/precision level requirement. COD levels will be monitored based on the table below.

Parameters for monitoring	Minimum sample size required for 90/10 confidence/precision level[1]	Actual sample size
COD of untreated, treated, and discharged wastewater	30 (based on a population of 54 samples)	54 (once every week)

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

>>

Baseline emissions

The baseline emissions are calculated as follow:

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

Baseline emissions from wastewater treatment system

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

:Value of parameters used in baseline emissions calculations

Parameters	Value	Source
$B_{o,ww}$	0.25 kg CH_4/kgCOD	Value as per AMS-III.H (version 16) paragraph 20.
$COD_{untreated,i,y}$	0.08668 tCOD/m^3	Average value over current monitoring period i.e. 16/04/2015 to 30/04/2016
$\eta_{COD,BL,i}$	85 %	Designed value as per manufacturer specification established in line with paragraph 28 (2) (b) of AMS-III.H version 16. Please refer Appendix-4 for details.
$Q_{ww,i,y}$	90691 m^3	Total wastewater treated during current monitoring period i.e. 16/04/2015 to 30/04/2016
$MCF_{ww,treatment,BL,i}$	0.8	IPCC value as per Table III.H.1 in AMS-III.H version 16. The plausible baseline scenario is the anaerobic lagoons with depth of more than 2m, therefore value of 0.8 is applied which is in line with the requirements of the methodology.
UF_{BL}	0.89[2]	Value as per AMS-III.H (version 16) paragraph 20.

[1] "Easy Sample"- a sampling software used for determining sample size.

[2] Reference: FCCC/SBSTA/2003/10/Add.2, page 25

Parameters	Value	Source
GWP_{CH4}	25	IPCC default value

$BE_{ww,treatment,y}$ = 90691* (0.0866795*85%*0.8)*0.25*0.89*25
= 29,734.44 tCO_2e

$BE_y = BE_{ww,treatment,y}$
= 29,734 tCO_2e (rounded down)

E.2. Calculation of project emissions or actual net GHG removals by sinks

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Project emissions

The emission from project activity is as follow:

$PE_y = PE_{power,y} + PE_{ww,discharge,y} + PE_{fugitive,y} + PE_{flaring,y}$

Project emissions calculations due to electricity consumption ($PE_{EC,y} = PE_{power,y}$)

$PE_{EC,y} = EC_{PJ,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y})$
$PE_{EC,y}$ = 14.3 * 1.3 * 1
$PE_{EC,y}$ = 18.59 tCO_2e

Project emissions from the treated wastewater discharged

$PE_{ww,discharge,y} = Q_{ww,y} * GWP_{CH4} * B_{o,ww} * UF_{PJ} * COD_{ww,discharge,PJ,y} * MCF_{ww,PJ,discharge}$
= 90691*25*0.25*1.12*0.00035*0.1
= 22.21 tCO_2e

Project emissions from biogas release in capture system

$MEP_{ww,treatment,y} = Q_{ww,i,y,} * B_{o,ww} * UF_{PJ} * COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$
= 90691*0.25*1.12* 0.063937*0.8
= 1298.866 tonnes CH_4

$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$
= (1 - 0.9) * 1298.86 * 25
= 3247.15 tCO_2e

$PE_{fugitive,y} = PE_{fugitive,ww,y}$ = 3247.15 tCO_2e

Value of parameters used in project emissions calculation

Parameter	Value	Source
$Q_{ww,i,y}$	90691 m^3	Total wastewater treated during current monitoring period i.e. 16/04/2015 to 30/04/2016
$COD_{inflow,i,y}$	0.0868 tCOD/m^3	Average over current monitoring period i.e. 16/04/2015 to 30/04/2016
$\eta_{COD,PJ}$	85 %	Designed value from manufacturer specification
$B_{o,ww}$	0.25 kg CH_4/kg COD	Value as per AMS-III.H (version 16) paragraph 20.
UF_{PJ}	0.89	Value as per AMS-III.H (version 16) paragraph 29.
$MCF_{ww,treatment,PJ,k}$	0.80	IPCC value as per Table 6.8 Volume 5 Chapter 6 of IPCC 2006 Guideline for anaerobic reactor

Project emissions due to incomplete flaring

$PE_{flaring,y} = F_{CH4,RG,m} * (1-\eta_{Flare,m}) * 10^{-3} * GWP_{CH4}$

Where,

$F_{CH4,RG,m}$ = 452843 m^3
$\eta_{Flare,m}$ = 0.5
GWP_{CH4}= 25

$PE_{flaring,y}$= 2908.77

The total project emission
$PE_y = PE_{power,y} + PE_{fugitive,y} + PE_{flaring,y} + PE_{ww,discharge,y}$

$PE_y = 18.59 + 22.219 + 3247.15 + 2908.77$

$PE_y = 6,196.72$ tCO_2e

$PE_y = 6,197$ tCO_2e (rounded up)

E.3. Calculation of leakage

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The project activity does not involve equipment transfer from another activity thus there are no leakages to be accounted for this project activity.
$LE_y = 0$

E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	GHG emission reductions or net GHG removals by sinks (t CO_2e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
Total	29734	6197	0	0	23537	23537

E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	60483	23537

E.6. Remarks on difference from estimated value in registered PDD

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There is a decrease of 61.08% from estimated ERs in registered PDD has been observed during this monitoring period (382 days). The palm oil mill was not operational at full load resulting lower value of POME, which is main input to project activity.

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

Project participant and/or responsible person/ entity	☒ Project participant ☒ Person/entity responsible for completing the CDM-MR-FORM
Organization name	PT Umbul Mas Wisesa
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Salutation	Mr.
Last name	Govindan
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Document information

Version	*Date*	*Description*
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.

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