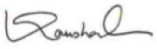
**Verification and certification report form for CDM project activities**

**(Version 02.1)**

*Complete this form in accordance with the instructions attached at the end of this form.*

| BASIC INFORMATION | |
|---|---|
| **Title and UNFCCC reference number of the project activity** | Biogas recovery from wastewater treatment in PT. Umbul Mas Wisesa Palm Oil Mill<br>UNFCCC Reference Number: 9197 |
| **Version number of the verification and certification report** | Version 04 |
| **Completion date of the verification and certification report** | 04/04/2019 |
| **Monitoring period number and duration of this monitoring period** | Monitoring period number: 01<br>Monitoring period: 16/04/2015 to 30/04/2016 |
| **Version number of the monitoring report to which this report applies** | 06 |
| **Crediting period of the project activity corresponding to this monitoring period** | 16/04/2015 to 15/04/2025 |
| **Project participants** | PT Umbul Mas Wisesa |
| **Host Party** | Indonesia |
| **Applied methodologies and standardized baselines** | Baseline and monitoring methodology applied: AMS-III.H "Methane recovery in wastewater treatment" (version 16) |
| **Mandatory sectoral scopes linked to the applied methodologies** | Sectoral scope 13 |
| **Conditional sectoral scope(s) linked to the applied methodologies** | Not Applicable |
| **Estimated amount of GHG emission reductions or GHG removals for this monitoring duration in the registered PDD** | 60167 $tCO_2e$ |
| **Certified amount of GHG emission reductions or GHG removals for this monitoring period** | 15553 $tCO_2e$ |
| **Name and UNFCCC reference number of the DOE** | Name: KBS Certification Services Pvt. Ltd.<br>UNFCCC Reference Number: E-0051 |
| **Name, position and signature of the approver of the verification and certification report** |  <br>Kaushal Goyal |

| | |
|---|---|
| | Managing Director<br>KBS Certification Services Pvt. Ltd. |

## SECTION A. Executive summary

>> **Purpose and generation description:**

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 as per the details available in the registered PDD /3/ and as verified during the onsite visit. Both, the palm oil mill as well as the wastewater treatment system with biogas recovery are Greenfield projects. The project activity site is located at South Labuhan Batu, Kampung Rakyat sub-district, North Sumatra Province, Sumatra Island, Indonesia.

The 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 /3/16/. 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 15,553 $tCO_2e$ /2/. Therefore, the project activity will reduce greenhouse gases due to avoidance of methane emissions

**Verification Scope:**

This report summarizes the findings of the verification of the project, performed on the basis of UNFCCC criteria for CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The objective of the verification is to have an independent review ex-post determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM project activity during a defined monitoring period. Certification is the written assurance by the DOE that, during a specific time period, a proposed CDM project activity achieved the reductions in anthropogenic emissions by sources of GHGs as verified.

The scope of the verification is to verify that:

- the actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan;
- the GHG emission reduction data and express a conclusion with a reasonable level of assurance about whether the reported GHG emission reduction data is free from material misstatement;
- the reported GHG emission data is sufficiently supported by evidence.

Verification shall ensure that reported emission reductions are complete and accurate in accordance with applicable UNFCCC criteria for CDM in order to be certified.
UNFCCC criteria for CDM refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures, for SSC project - the simplified modalities and procedures for small-scale CDM project activities and the subsequent decisions by the CDM Executive Board /23/24/25/.

**Verification process:**
Verification is conducted using KBS procedures in line with the requirements specified in the latest version of the CDM Validation and Verification Standard /24/, relevant decisions of the CDM EB and /23/25/ applying standard auditing techniques. KBS assesses and determines that the implementation and operation of the project activity, and steps taken to report emission reductions comply with the CDM criteria and relevant guidance provided by the Board. The verification assessment involved a document review of relevant documentation and the on-site visit. Verification is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the monitoring.

**Conclusion:**
In conclusion, it is KBS's opinion that the project activity "Biogas recovery from wastewater treatment in PT. Umbul Mas Wisesa Palm Oil Mill", as described in the final Monitoring report /1/, meets all relevant requirements for CDM project activities /23/24/25/ and all relevant host Party criteria and correctly applies the approved baseline and monitoring methodology AMS-III.H, version 16: "Methane recovery in wastewater treatment" /27/.

## SECTION B. Verification team, technical reviewer and approver

### B.1. Verification team member

| No. | Role | Type of resource | Last name | First name | Affiliation (e.g. name of central or other office of DOE or outsourced entity) | Involvement in | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Desk/document review | On-site inspection | Interviews | Verification findings |
| 1 | Team Leader and Technical Expert (TA 13.1) | IR | Kandari | Sanjay | Central Office | ✓ | ✓ | ✓ | ✓ |
| 2 | Verifier and Technical Expert | IR | Badaya | Rohit | Central Office | ✓ | | | ✓ |
| 3 | Local Expert | EI | Sembiring | Yenni | Central Office | | ✓ | ✓ | |

### B.2. Technical reviewer and approver of the verification and certification report

| No. | Role | Type of resource | Last name | First name | Affiliation (e.g. name of central or other office of DOE or outsourced entity) |
|---|---|---|---|---|---|
| 1 | Technical Reviewer | IR | Kanal | M P | Central Office |
| 2 | Technical Reviewer | IR | Sharma | Chetan Swaroop | Central Office |
| 3 | Manager Technical & Certification | IR | Sharma | Chetan Swaroop | Central Office |
| 4 | Authorizer | IR | Goyal | Kaushal | Central Office |

## SECTION C. Application of materiality

### C.1. Consideration of materiality in planning the verification

| No. | Risk that could lead to material errors, omissions or misstatements | Assessment of the risk | | Response to the risk in the verification plan and/or sampling plan |
|---|---|---|---|---|
| | | Risk level | Justification | |
| 1. | Human Errors | Medium | Human error is likely to occur if the monitoring personnel are not trained well or inexperienced in data recording procedures and monitoring processes. | Wherever there is a greater likelihood of errors and chances of incorrect transfer of data, effective data verification should be done on those days/months data. Noted that the data recording is performed by trained personnel and all the personnel involved in data storage and archiving are undergone training yearly. |
| 2. | Design of data management | Medium | Use of spreadsheets without adequate data control, changes/updates, version tracking, traceability and security | Depending on how data is generated, processed, and reported, place greater emphasis on verifying data captured and processed manually and/or in spreadsheets versus those that are generated from an automated system |
| 3 | Manual data | Low | Typographic errors in the spreadsheets and log books while recording. | Require the PPs to assess all the data again and confirm that no further errors are made |

### C.2. Consideration of materiality in conducting the verification

>>

In order to detect errors, omissions or misstatements in emission reductions or removals being claimed by project participants in the monitoring report, the materiality have been applied by KBS as per clause 9.1.2.3 of CDM VVS for project activities, Version 02.0 /24/. The project is a small scale CDM project activity and 5 percent materiality threshold is applied.

1. In planning the verification, KBS is able to understand the environment in which the project activity operates, the sources of project emissions within the project boundary and the leakage, the monitoring activities, the equipment used to monitor or measure activity data, the origin and application of data used to calculate or measure the emissions, data flow, the internal quality control system, and the overall organization with respect to monitoring and reporting.
2. A verification plan has been designed to minimize risks that a material discrepancy would not be detected. The project activity happens at a single site and complete data is available for verification. The data which directly affect emission reduction calculations are monitored and measured by calibrated meters, hence are verifiable. The data log sheets of the parameters used in ER calculations were verified and found correct. The use of spreadsheets shows the adequate controls related to data updates, version tracking, traceability and security.
3. During the course of the verification, no errors related to the materiality threshold of 5 per cent have been identified in the data set. Further, any individual or aggregate errors, omission or misstatement identified, which resulted in discrepancies have been considered material and requested to be corrected.

KBS confirms that the claimed emission reductions are free from material errors, omissions or misstatements, with a reasonable level of assurance, and proceeds with the verification as defined in the verification plan.

## SECTION D. Means of verification

### D.1. Desk/document review

>> The publicly available monitoring report, version 01 dated 31/05/2016 /1/ and final version of the monitoring report /1/, the emission reduction calculations provided in the form of a spreadsheet (version 01 dated 31/05/2016 and final version corresponding to the final monitoring report) /2/ were assessed as part of the verification.

In addition the Project Design Document (PDD) /3/ in particular the baseline estimations and the monitoring plan for the project activity was reviewed. The list of all documents reviewed & referenced during the verification are available in the Appendix 3 below of the Report.

The monitoring report version 01 dated 31/05/2016 /1/ was made publicly available on the CDM UNFCCC website.

## D.2. On-site inspection

| Duration of on-site inspection: 22/11/2016 /13/ | | | | |
|---|---|---|---|---|
| **No.** | **Activity performed on-site** | **Site location** | **Date** | **Team member** |
| 1. | During the on-site assessment of the project, KBS assessed the implementation and operation of the proposed project activity, reviewed the information flows for generating, aggregating and reporting the monitoring parameters, interviewed key personnel of the plant to confirm the operational and data collection procedures, cross-checked between information provided in the monitoring report and data plant. The values used in the ER calculations were confirmed by means of checking the records provided by the client. Checked the quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters. There were no hindrances or barriers that were faced by the verification team while carrying out the site visits and all equipment and processes of the project activity were accessible. | South Labuhan Batu Regency, Kampung Rakyat sub-district, North Sumatra Province, Sumatra Island, Indonesia | 22/11/2016 | Sanjay Kandari<br>Yenni Sembiring |

## D.3. Interviews

| **No.** | **Interviewee** | | | **Date** | **Subject** | **Team member** |
|---|---|---|---|---|---|---|
| | **Last name** | **First name** | **Affiliation** | | | |
| 1. | Chand | Phool | Consultant, PARS Consultants | 22/11/2016 | Project implementation, status, construction and actual operation.<br><br>Monitoring plan and monitoring parameters for this monitoring period.<br><br>Emission Reduction calculation.<br><br>QA/QC procedures<br><br>Environmental Impacts<br><br>ER calculations and calibration details | Sanjay Kandari<br>Yenni Sembiring |
| 2. | Sratt | Heni Setiawan | Act OA, UMW-POM | 22/11/2016 | | |
| 3. | Gulo | Fotuho | Act MHA, UMW-POM | 22/11/2016 | | |
| 4. | Zolkarnain | T. Dedy | Manager, UMW-POM | 22/11/2016 | | |

## D.4. Sampling approach

>> Not Applicable

### D.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

| Areas of verification findings | No. of CL | No. of CAR | No. of FAR |
|---|---|---|---|
| Compliance of the monitoring report with the monitoring report form | - | 01 | - |
| Compliance of the project implementation and operation with the registered PDD | 01 (part of CL 01) | - | - |
| Post-registration changes | - | - | - |
| Compliance of the registered monitoring plan with the methodologies including applicable tools and standardized baselines | - | - | - |
| Compliance of monitoring activities with the registered monitoring plan | 01 (part of CL 01) | 03 | - |
| Compliance with the calibration frequency requirements for measuring instruments | - | - | - |
| Assessment of data and calculation of emission reductions or net removals | - | 01 | - |
| Assessment of reported sustainable development co-benefits | - | - | - |
| Global stakeholder consultation | - | - | - |
| Others- Incomplete issues raised by UNFCCC Secretariat | - | 02 | - |
| **Total** | 01 | 07 | 00 |

## SECTION E. Verification findings

### E.1. Compliance of the monitoring report with the monitoring report form

| | |
|---|---|
| **Means of verification** | To check the compliance of the monitoring report with the latest monitoring report form /21/ available on the UNFCCC website. |
| **Findings** | CAR 01 was raised during the verification process which was successfully closed. Refer Appendix 4 of the Verification report for details. |
| **Conclusion** | The latest version of MR form available on UNFCCC website is 06.0 and the same has been used by the project proponent for the preparation of monitoring report. KBS confirms that the above MR is based on the currently valid MR template /21/ and is completed in accordance with the applicable filling guidelines /22/. |

### E.2. Remaining forward action requests from validation and/or previous verifications

>> This is 1st verification of the project activity. There are no FAR(s) from validation /4/ or previous verification reports /4/ that needs to be closed during this verification.

### E.3. Compliance of the project implementation and operation with the registered project design document

| | |
|---|---|
| **Means of verification** | As checked during the site visit /13/, the project activity replaces the existing wastewater treatment practice (open anaerobic lagoon system) without biogas recovery and thus avoids the release of methane into the atmosphere that results from the anaerobic digestion of the organic content in the wastewater treated in the lagoon system. Hence 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 /14/15/18/19/. 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 /16/17/. 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.<br><br>The technology /14/ applied for the project activity involves various processes which includes:<br>Upstream pre-treatment systems which includes Equalization Tank, Plate Heat Exchanger (PHE), Dissolve Air Floatation System (DAF), Primary Clarifier, Buffer |

| | |
|---|---|
| | Tank. The reactor used is Anaerobic Continuously Stirrer Tank Reactor (CSTR) /14/.<br><br>Downstream treatment systems include Conventional Aeration Tank, Secondary Clarifier-A, Extended Aeration Tank, Secondary Clarifier-B, Chlorine Contact Tank, De-Chlorine Tank (DCT), Multi Grade Filter (MGF), Activated Carbon Filter (ACF) /14/.<br><br>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.<br><br>During the site visit, it was checked that the construction for project activity started in May 2013, commissioning started in April 2014 and project activity has been commissioned on 01/04/2015 /16/. The commissioning reports were checked during the verification. 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 resulted into the emission reductions.<br><br>However at the time of site visit, it was observed that the flare detection system was not installed during the current monitoring period, hence flare efficiency has been considered as zero for calculating project emissions due to flaring, which is conservative. A separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs.<br><br>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. It has been checked that there is no change in the technical design and the equipments used in the project activity and hence is in line with the registered PDD. Hence CAR 03 was raised during the verification process. |
| **Findings** | CAR 03 was raised during the verification process which was successfully closed. Refer Appendix 4 of the verification report for details. |
| **Conclusion** | The project has been implemented according to the description presented in the registered PDD, expect that the flare detection system was not installed during the current monitoring period. Hence the flare efficiency has been considered as zero for calculating project emissions due to flaring, which is conservative. A request for post-registration changes is being submitted together with this submission of this request for issuance of CERs.<br><br>KBS confirms, through physical inspection at project site that all features of the CDM project activity including the equipments, data collecting systems and storage have been implemented, except flare detection system in accordance with the registered PDD. The same has been confirmed during on-site visit. |

## E.4. Post-registration changes

### E.4.1. Temporary deviations from the registered monitoring plan, applied methodologies or applied standardized baselines

>>

During the site visit, it was observed that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs. CAR 03 was raised during the verification process which was successfully closed. Refer Appendix 4 of the verification report for details.

### E.4.2. Corrections

>> Not Applicable

### E.4.3. Change to the start date of the crediting period of the project activity

>> Not Applicable

### E.4.4. Inclusion of a monitoring plan

>> Not Applicable

### E.4.5. Permanent changes from registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines or other applied standards or tools

>> Not Applicable

### E.4.6. Changes to the project design

>> Not Applicable

### E.4.7. Changes specific to afforestation and reforestation project activities

>> Not Applicable

## E.5. Compliance of the registered monitoring plan with the methodology including applicable tools and standardized baselines

| | |
|---|---|
| **Means of verification** | During the monitoring period it was noted that the parameters monitored (also discussed in detail in section E.6.2) and the monitoring plan was found as per the applied methodology /27/, applicable methodological tools /28/ and registered PDD /3/. However it was observed that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs.<br>Hence CAR 03 was raised during the verification process. |
| **Findings** | CAR 03 was raised during the verification process which was successfully closed. Refer Appendix 4 of the verification report for details. |
| **Conclusion** | The parameters monitored and the monitoring plan was found as per the applied methodology, applicable methodological tools and registered PDD, except the flare detection system. It was observed that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs.<br>Expect this above deviation, there is no deviation observed between monitoring plan of the project activity with the monitoring plan of the applied methodology of the project activity and all the monitoring parameters, monitoring and calibration procedures follow the methodology requirements. |

## E.6. Compliance of monitoring activities with the registered monitoring plan

### E.6.1. Data and parameters fixed ex ante or at renewal of crediting period

| | |
|---|---|
| **Means of verification** | Data and parameters fixed ex-ante as listed in the monitoring report have been crosschecked and reviewed as applicable against the monitoring plan of the registered PDD, as well as against the applied methodology and other relevant CDM documentation. |

| Data/Parameter & Unit | Source of data | Reported value for the monitoring period | Assessment/Observation |
|---|---|---|---|
| **$GWP_{CH4}$ :** Global warming potential of methane ($tCO_{2e}/tCH_4$) | IPCC value as per paragraph 20 of AMS-III.H (version 16) /27/ | 25 | The IPCC default value /20/ is as per the paragraph 20 of the applied methodology AMS-III.H (version 16) /27/. As per Annex 3, EB 69, following decision 4/CMP.7 the GWP of CH4 for the second commitment period (from 01/01/2013 onwards) has been applied. |
| **Bo,ww :** Methane producing capacity of the wastewater (kg CH4/kg COD) | IPCC default value | 0.25 | The IPCC default value/20/ is as per the paragraph 20 of applied methodology AMS-III.H (version 16) /27/.<br><br>The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| **$\eta_{COD,BL,i}$ :** COD removal efficiency of the baseline treatment system i (%) | As per the paragraph 28 (2) (b) of the baseline and monitoring methodology AMS-III.H (version 16). | 85 | The value is as per the paragraph 28 (2) (b) of the baseline and monitoring methodology AMS-III.H (version 16) /27/.<br>The value is fixed ex-ante, as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| **$\eta_{COD,PJ,j}$ :** COD removal efficiency of the project treatment system j (%) | As per the registered PDD . | 85 | The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| **$MCF_{ww,treatment,BL,i}$** Methane correction factor for baseline wastewater treatment system (fraction) | Table III.H.1 in AMS-III.H (version 16) | 0.80 | The default value is as per the applied methodology AMS-III.H (version 16).<br>The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by the validation DOE. |
| **$MCF_{ww,treatment\ PJ,k}$** Methane correction factor for project wastewater treatment system k (factor) | Table III.H.1 in AMS-III.H (version 16) | 0.80 | The value is as per the Table III.H.1 in AMS-III.H (version 16). The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE |
| **MCFww,PJ,discharge** Methane correction factor based on the discharge | Table III.H.1 in AMS-III.H (version 16) | 0.1 | The value is as per the Table III.H.1 in AMS-III.H (version 16)<br>The value is fixed ex-ante as per the registered PDD /03/, which has been |

| | | | | |
|---|---|---|---|---|
| | pathway of the wastewater in the project scenario (e.g. into sea, river or lake) (factor) | | | justified and validated by validation DOE. |
| | **CFEww:** Capture efficiency of the biogas recovery equipment in the wastewater treatment systems (Factor) | Default value as per paragraph 30(a) Eq 10 of AMS-III.H version 16 | 0.9 | The value is as per the default value as per paragraph 30(a), equation 10 of AMS-III.H version 16 /27/.<br>The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| | **$UF_{BL}$:**<br>Model correction uncertainty factor to account for model uncertainties (fraction) | As per paragraph 22 of AMS-III.H (version 16) | 0.89 | The value is as per the paragraph 22 of AMS-III.H (version 16). The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| | **$UF_{PJ}$:**<br>Model correction to account for model uncertainties (fraction) | As per the paragraph 30(a) Eq 11 of AMS-III.H (version 16) | 1.12 | The value is as per the paragraph 30(a) Eq 11 of AMS-III.H (version 16) /27/.<br>The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| | **$EF_{EL,j,y}$**<br>Emission factor for electricity generation for source j in year y, where j is the source of electricity consumption in the project ( tCO2/MWh), (fraction) | Default value as per EB 39, Annex 7 (AMS-III.H version 16 Para 29) | 1.3 | The value is as per the default value under option B2 of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" (EB 39, Annex 7) /28/.<br>The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE. |
| | **Hflare**<br>Flare efficiency (Fraction) | Default v lue f r open flaring as per "Project emissions from flaring" | 0.5, if flare is detected in a minute.<br>0, otherwise | The value is as per the default value for open flaring as per "Project emissions from flaring" /28/.<br>The value is fixed ex-ante as per the registered PDD /3/, which has been justified and validated by validation DOE. |
| | **Ru**<br>Universal ideal gases constant (Pa.m3/kmol.K) | Tool to determine the mass flow of a greenhouse gas in a gaseous stream | 8,314 | The value is as per the "Tools to determine the mass flow of a greenhouse gas in a gaseous stream" /28/.<br>The value is fixed ex-ante as per the registered PDD, which has been justified and validated by validation |

| | | | | |
|---|---|---|---|---|
| | | | | DOE. |
| | **Mmi** Molecular mass of greenhouse gas i (kg/kmol) | Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0) | 16.04 | The value is as per the default value from "Tool to determine the mass flow of a greenhouse gas in a gaseous stream (version 02.0.0) /28/. The value is fixed ex-ante as per the registered PDD /03/, which has been justified and validated by validation DOE |
| **Findings** | Not Applicable | | | |
| **Conclusion** | KBS is able to confirm that the data and parameters fixed ex ante have been implemented in full compliance with the monitoring plan and that they are the same used at the validation stage. The data and parameters fixed ex ante have been found to be inline with the registered PDD. | | | |

## E.6.2. Data and parameters monitored

**Means of verification**

During the verification process, the whole set of monitoring parameters relevant to the proposed project activity (as listed in chapter B.7.1 of the registered PDD and D.2 of MR), the figures as reported in the final version of MR version/1/ and the information flow management system have been verified with regard to the appropriateness of the applied measurement and equipment, the correctness of the values applied for calculation of GHG emission reductions, the accuracy and applied QA/QC measures. The monitored parameters described in the MR are described as follows:

| **Data/parameter:** | **$Q_{ww,i,y}$** |
|---|---|
| Data Unit | $m^3$ |
| Description | Monthly volume of untreated wastewater entering (inflow) the anaerobic digester in project activity |
| Source of data to be used | Plant records /6/ |
| Value(s) of monitored parameter | 90691 |
| Monitoring equipment | Flow meter /9/14/ at the inlet of the anaerobic digester.<br>Make: Endress+Hauser<br>Type: PROMAG 10 P3<br>Serial No: FB02E020000<br>Accuracy: ±0.5 % |
| Accuracy of the monitoring equipment | The accuracy of the meter is ±0.5%, which is in compliance with the registered PDD /01/, and also in line with the national industrial standards. |
| Calibration frequency/interval | Calibration frequency: Once in 3 years<br>Calibration date: 20/08/2014 /9/<br><br>The calibration was conducted in line with the registered PDD and applicable to the monitoring period from 16/04/2015 to 30/04/2016 |

| | |
|---|---|
| Data Cross Checking: | The operational conditions of the monitoring equipment were assessed through interview during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br><br>The data is continuous monitored, hourly measured and monthly recorded. The measurements are undertaken by using the flowmeter at the inlet of the anaerobic digester. The monthly volume of the untreated wastewater was verified through the review of monitoring records and interviews during the site visit. |
| Consistency as per the QA/QC defined in the methodology | It was verified that PP fulfills the proposed QA/QC procedures as per the applicable methodology. The data is monitored continuously and hourly measurements are undertaken and this procedure is in line with requirements set out in applicable methodology. |
| Consistency as per the QA/QC established by the project participants in the PDD | QA/QC procedures taken by the project activity are in line with the proposed procedures in the PDD as well as the applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. The calibration procedures are also in line with the methodology and the requirements of the registered PDD. |

| **Data/parameter:** | **$COD_{untreated,i,y}$ or $COD_{inflow,i,y}$** |
|---|---|
| Data Unit | $tCOD/m^3$ |
| Description | Chemical Oxygen Demand of the wastewater entering the Anaerobic Digester |
| Source of data to be used | Representative sampling by the PP and Plant records /5/ |
| Value(s) of monitored parameter | 0.86705 |

| | | |
|---|---|---|
| | Monitoring equipment | COD Calorimeter<br>Make: HACH Company<br>Type: DR/890 Calorimeter<br>Serial No: 101190C80529<br>Accuracy: Class 1 LED Product<br><br>As per monitoring plan of registered PDD the sample size for proposed project was calculated using 10 days campaign in beginning of monitoring period inline with Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) /26/, which comes out to be around 6 samples per annum. However the actual practice at the project site is that the test is conducted on daily or at least weekly basis and monthly average has been taken for calculation of emission reduction. Hence the actual practice leads to more accurate estimation of the COD values and also results into a conservative estimate of the values.<br><br>The measurement of COD is conducted as per standard practice. The COD measured through representative sampling on daily or at least weekly basis. The COD measurement is conducted using COD Calorimeter, a digital meter /14/, wherein the sample is used to measure the COD value at specified temperature inline with manual /14/. The COD calorimeter is a digital meter and can be reset to factory calibration as per user requirement. |
| | Accuracy of the monitoring equipment | The Calorimeter is Class 1 LED Product, which is in compliance with the registered PDD /01/, and also in line with the national industrial standards. |
| | Calibration frequency/interval | The COD calorimeter is a digital meter and can be reset to factory calibration as per user requirement and hence a separate calibration is not required /14/. |
| | Data Cross Checking: | The procedure for the measurement of COD of the wastewater entering the Anaerobic Digester was verified during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br>The data is recorded on daily or at least weekly basis based on sample test and monthly average has been taken for calculation of emission reduction. The monitoring records were cross checked to verify the data for the parameter and found correct. |

| | |
|---|---|
| Consistency as per the QA/QC defined in the methodology | As per monitoring plan of registered PDD the sample size for proposed project was calculated using 10 days campaign in beginning of monitoring period inline with Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) /26/, which comes out to be around 6 samples per annum. However the actual practice at the project site is that the test is conducted on daily or at least weekly basis and monthly average has been taken for calculation of emission reduction. Hence the actual practice leads to more accurate estimation of the COD values and also results into a conservative estimate of the values.<br><br>It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The measured COD ensures the 90/10 confidence/precision level and follows the national and international standards which are in line with the applied methodology and registered PDD. The COD values have been crosschecked with the plant records and found Ok. |
| Consistency as per the QA/QC established by the project participants in the PDD | It was verified that PP fulfills the proposed QA/QC procedures detailed in line with the "Best Practice Examples Focusing on Sample Size and Reliability Calculations" /26/, accordance with the applied methodology and the registered PDD. Additionally the PP conducts the COD measurements on daily or atleast weekly basis as part of the standard practice. The COD values have been crosschecked with the plant records and found Ok.<br><br>QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. |

| **Data/parameter:** | **$COD_{ww,treated,y}$** |
|---|---|
| Data Unit | $tCOD/m^3$ |
| Description | Chemical oxygen demand of the treated wastewater leaving the anaerobic digester |
| Source of data to be used | Representative sampling by the PP and Plant records /5/ |
| Value(s) of monitored parameter | 0.021245 |

| | | |
|---|---|---|
| | Monitoring equipment | COD Calorimeter<br>Make: HACH Company<br>Type: DR/890 Calorimeter<br>Serial No: 101190C80529<br>Accuracy: Class 1 LED Product<br><br>As per monitoring plan of registered PDD the sample size for proposed project was calculated using 10 days campaign in beginning of monitoring period inline with Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) /26/, which comes out to be around 6 samples per annum. However the actual practice at the project site is that the test is conducted on daily or at least weekly basis and monthly average has been taken for calculation of emission reductions. Hence the actual practice leads to more accurate estimation of the COD values and also results into a conservative estimate of the values.<br><br>The measurement of COD is conducted as per standard practice. The COD measured through representative sampling on daily or at least weekly basis. The COD measurement is conducted using COD Calorimeter, a digital meter /14/, wherein the sample is used to measure the COD value at specified temperature inline with manual. The COD calorimeter is a digital meter and can be reset to factory calibration as per user requirement. |
| | Accuracy of the monitoring equipment | The Calorimeter is Class 1 LED Product, which is in compliance with the registered PDD /01/, and also in line with the national industrial standards. |
| | Calibration frequency/interval | The COD calorimeter is a digital meter and can be reset to factory calibration as per user requirement and hence a separate calibration is not required /14/. |
| | Data Cross Checking: | The procedure for the measurement of COD of the wastewater leaving the Anaerobic Digester was verified during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br>The data is recorded on daily or at least weekly basis based on sample test and monthly average has been taken for calculation of emission reduction. The monitoring records were cross checked to verify the data for the parameter and found correct. |

| | |
|---|---|
| Consistency as per the QA/QC defined in the methodology | As per monitoring plan of registered PDD the sample size for proposed project was calculated using 10 days campaign in beginning of monitoring period inline with Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) /26/, which comes out to be around 6 samples per annum. However the actual practice at the project site is that the test is conducted on daily or at least weekly basis and monthly average has been taken for calculation of emission reduction. Hence the actual practice leads to more accurate estimation of the COD values and also results into a conservative estimate of the values.<br><br>It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The measured COD ensures the 90/10 confidence/precision level and follows the national and international standards which are in line with the applied methodology and registered PDD. The COD values have been crosschecked with the plant records and found Ok. |
| Consistency as per the QA/QC established by the project participants in the PDD | It was verified that PP fulfills the proposed QA/QC procedures detailed in line with the "Best Practice Examples Focusing on Sample Size and Reliability Calculations" /26/, accordance with the applied methodology and the registered PDD. Additionally the PP conducts the COD measurements on daily or atleast weekly basis as part of the standard practice. The COD values have been crosschecked with the plant records and found Ok.<br><br>QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. |

| **Data/parameter:** | **$COD_{ww,discharge,pj,y}$** |
|---|---|
| Data Unit | $tCOD/m^3$ |
| Description | Chemical oxygen demand of the treated wastewater discharged into sea river or lake |
| Source of data to be used | Representative sampling by the PP and Plant records /5/ |
| Value(s) of monitored parameter | 0.00035 |

| | | |
|---|---|---|
| | Monitoring equipment | COD Calorimeter<br>Make: HACH Company<br>Type: DR/890 Calorimeter<br>Serial No: 101190C80529<br>Accuracy: Class 1 LED Product<br><br>As per the monitoring plan of registered PDD the sample size for proposed project was calculated using 10 days campaign in beginning of monitoring period inline with Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) /26/, which comes out to be around 5 samples per annum. However the actual practice at the project site is that the test is conducted on daily or at least weekly basis and monthly average has been taken for calculation of emission reduction. Hence the actual practice leads to more accurate estimation of the COD values and also results into a conservative estimate of the values.<br><br>The measurement of COD is conducted as per standard practice. The COD measured through representative sampling on daily or at least weekly basis. The COD measurement is conducted using COD Calorimeter, a digital meter /14/, wherein the sample is used to measure the COD value at specified temperature inline with manual. The COD calorimeter is a digital meter and can be reset to factory calibration as per user requirement. |
| | Accuracy of the monitoring equipment | The Calorimeter is Class 1 LED Product, which is in compliance with the registered PDD /01/, and also in line with the national industrial standards. |
| | Calibration frequency/interval | The COD calorimeter is a digital meter and can be reset to factory calibration as per user requirement and hence a separate calibration is not required /14/. |
| | Data Cross Checking: | The procedure for the measurement of COD of the wastewater discharged was verified during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br>The data is recorded on daily or at least weekly basis based on sample test and monthly average has been taken for calculation of emission reduction. The monitoring records were cross checked to verify the data for the parameter and found correct. |

| | |
|---|---|
| Consistency as per the QA/QC defined in the methodology | As per monitoring plan of registered PDD the sample size for proposed project was calculated using 10 days campaign in beginning of monitoring period inline with Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) /26/, which comes out to be around 5 samples per annum. However the actual practice at the project site is that the test is conducted on daily or at least weekly basis and monthly average has been taken for calculation of emission reduction. Hence the actual practice leads to more accurate estimation of the COD values and also results into a conservative estimate of the values.<br><br>It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The measured COD ensures the 90/10 confidence/precision level and follows the national and international standards which are in line with the applied methodology and registered PDD. The COD values have been crosschecked with the plant records and found Ok |
| Consistency as per the QA/QC established by the project participants in the PDD | It was verified that PP fulfills the proposed QA/QC procedures detailed in line with the "Best Practice Examples Focusing on Sample Size and Reliability Calculations" /26/, accordance with the applied methodology and the registered PDD. Additionally the PP conducts the COD measurements on daily or atleast weekly basis as part of the standard practice. The COD values have been crosschecked with the plant records and found Ok.<br><br>QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. |

| **Data/parameter:** | **Vt,db** |
|---|---|
| Data Unit | $m^3$ dry gas/h |
| Description | Volumetric flow rate of the gaseous stream in time interval t on a dry basis |
| Source of data to be used | Plant records /6/ |
| Value(s) of monitored parameter | The volumetric flow rate of the biogas generated is 267 $m^3$ dry gas/h (average over current monitoring period)<br><br>The total biogas generated through the treatment of the wastewater in the project activity. The total volumetric flow rate is measured as the sum of the measured flow rate of biogas for combustion in the boiler in palm oil mill and measured flow rate of the excess biogas going for the flaring. The same was checked and confirmed during the site visit. |

<table>
<tr><td>Monitoring equipment</td><td>The total biogas generated through the treatment of the wastewater in the project activity. The total volumetric flow rate is measured as the sum of the measured flow rate of biogas for combustion in the boiler in palm oil mill (gas flow meter located on the boiler line) and measured flow rate of the excess biogas going for the flaring (gas flow meter located on the flare line).. The same was checked and confirmed during the site visit.<br><br>The biogas gaseous stream generated is bifurcated into two streams, one stream is directed to the boiler system for the combustion purpose and other stream is sent to the flare system installed as part of the project activity. Each of the gas streams are measured with the help of flow meters installed before the boiler and flare equipment installed under the project respectively.<br><br>The technical details of the installed meters are as follows:<br>Gas Flow meter for measuring the biogas sent to the Boiler
<table>
<tr><td>Make</td><td>Endress+Hauser</td></tr>
<tr><td>Type</td><td>PROWIRL 73 F3</td></tr>
<tr><td>Serial No</td><td>FB02D820000</td></tr>
<tr><td>Accuracy</td><td>±1.5 %</td></tr>
</table>
Gas Flow meter for measuring the biogas sent to the Flare system
<table>
<tr><td>Make</td><td>Endress+Hauser</td></tr>
<tr><td>Type</td><td>PROSONIC FLOW B 200 DN150 / 6"</td></tr>
<tr><td>Serial No</td><td>K508BF02000</td></tr>
<tr><td>Accuracy</td><td>±1.5 %</td></tr>
</table></td></tr>
<tr><td>Accuracy of the monitoring equipment</td><td>The accuracy of the meter is ±1.5 %, which is in compliance with the registered PDD /03/, and also in line with the national industrial standards.</td></tr>
<tr><td>Calibration frequency/interval</td><td>
<table>
<tr><td>Calibration frequency</td><td>Once in 3 years</td></tr>
<tr><td>Calibration date</td><td>11/08/2014</td></tr>
</table>
The calibration was conducted in line with the registered PDD and applicable to the monitoring period from 16/04/2015 to 30/04/2016</td></tr>
<tr><td>Data Cross Checking:</td><td>The operational conditions of the monitoring equipment were assessed through interview during the site visit. In addition, it was verified procedure followed in order to verify the data collection and reporting.<br><br>The data is continuous monitored, hourly measured and monthly recorded. The measurements are undertaken by using the Gas Flowmeter. The volume flow measurement of the gas was verified through the review of monitoring records and interviews during the site visit.</td></tr>
<tr><td>Consistency as per the QA/QC defined in the methodology</td><td>It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The data is monitored continuously and hourly measurements are undertaken and this procedure is in line with requirements set out on applicable methodology.</td></tr>
</table>

| | |
|---|---|
| Consistency as per the QA/QC established by the project participants in the PDD | QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. The calibration procedures are also in line with the methodology and the registered PDD requirements. |

| **Data/parameter:** | **vi,t,db** |
|---|---|
| Data 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 |
| Source of data to be used | Onsite record /6/14/ |
| Value(s) of monitored parameter | 0.7177 |
| Monitoring equipment | Meter<br>Make-Endress+Hauser<br>Type: PROWIRL 73 F3<br>Serial No. FB02D820000 /10/<br>Accuracy-±1.5%<br>Calibration Frequency- once in 3 years<br>Date of calibration- 11/08/2014 |
| Accuracy of the monitoring equipment | The accuracy of the meter is ±1.5%, which is in compliance with the registered PDD /01/, and also in line with the national industrial standards. |
| Calibration frequency/interval | Calibration frequency: Once in 3 years<br>Calibration date: 11/08/2014<br><br>The calibration was conducted in line with the registered PDD and applicable to the monitoring period from 16/04/2015 to 30/04/2016 |
| Data Cross Checking: | The operational conditions of the monitoring equipment were assessed through interview during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br><br>The data is continuous monitored, daily measured and monthly recorded. The measurements are undertaken by using the meter. The measurement was verified through the review of monitoring records and interviews during the site visit. |
| Consistency as per the QA/QC defined in the methodology | It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The data is monitored continuously and daily measurements are undertaken and this procedure is in line with requirements set out on applicable methodology. |

| | |
|---|---|
| Consistency as per the QA/QC established by the project participants in the PDD | QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. The calibration procedures are also in line with the methodology and the registered PDD requirements. |

| **Data/parameter:** | **Flame,m** |
|---|---|
| Data Unit | Flame on or Flame off |
| Description | Flame detection of flare in the minute m |
| Source of data to be used | Flare detection system |
| Value(s) of monitored parameter | 0<br>No flare detector was installed during current monitoring period, The same was checked and confirmed during the site visit. |
| Monitoring equipment | No flare detector was installed during current monitoring period |
| Accuracy of the monitoring equipment | No flare detector was installed during current monitoring period |
| Calibration frequency/interval | No flare detector was installed during current monitoring period |
| Data Cross Checking: | No flare detector was installed during current monitoring period |
| Consistency as per the QA/QC defined in the methodology | No flare detector was installed during current monitoring period |
| Consistency as per the QA/QC established by the project participants in the PDD | No flare detector was installed during current monitoring period |
| Conclusion | No flare detector was installed during current monitoring period. The same was checked and confirmed during the site visit.<br><br>At the time of site visit, it was observed that the flare detection system was not installed during the current monitoring period, hence flare efficiency has been considered as zero for calculating project emissions due to flaring, which is conservative. A separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs. |

| Data/parameter: | $EC_{PJ,j,y}$ |
|---|---|
| Data Unit | MWh/yr |
| Description | Quantity of electricity consumed by the project electricity consumption source j in year y |
| Source of data to be used | Electricity meters, Plant records and JMRs /8/ |
| Value(s) of monitored parameter | 14.3 |
| Monitoring equipment | Energy Meters /11/<br>Make: Schneider<br>Type: EM6436<br>Serial No: 34170811203<br>Accuracy: 0.5s |
| Accuracy of the monitoring equipment | The accuracy of the meter is 0.5s, which is in compliance with the registered PDD /03/, and also in line with the national industrial standards. |
| Calibration frequency/interval | Calibration frequency: Once in 3 years<br>Calibration date: 01/04/2015<br><br>The calibration was conducted in line with the registered PDD and applicable to the monitoring period from 16/04/2015 to 30/04/2016 |
| Data Cross Checking: | The operational conditions of the monitoring equipment were assessed through interview during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br><br>The data is continuous monitored, monthly recorded. The data will be recorded on a monthly basis from main meter at the site. Based on the recorded data, Joint Meter Readings (JMR) is issued to the PP on a monthly basis.<br>The monthly JMR was verified through the review of records and interviews during the site visit. |
| Consistency as per the QA/QC defined in the methodology | It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The data is monitored continuously and monthly recordings are undertaken and this procedure is in line with requirements set out on applicable methodology and "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*". |
| Consistency as per the QA/QC established by the project participants in the PDD | QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology and Tool. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology and Tool. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. The calibration procedures are also in line with the methodology, applicable Tool and the registered PDD requirements. |

| Data/parameter: | Tt |
|---|---|
| Data Unit | K |
| Description | Temperature of the gaseous stream in time interval t (K) |
| Source of data to be used | Plant records |
| Value(s) of monitored parameter | Temperature meter is not used as methane content is directly monitored by gas flow meter /6/14/ |
| Monitoring equipment | As per the registered PDD, the temperature meter shall be used based on the requirements, if applicable. During the monitoring period, the temperature meter was not used as the methane content is directly monitored by gas flow meter. |
| Accuracy of the monitoring equipment | N/A |
| Calibration frequency/interval | N/A |
| Data Cross Checking: | N/A |
| Consistency as per the QA/QC defined in the methodology | N/A |
| Consistency as per the QA/QC established by the project participants in the PDD | N/A |
| Conclusion | As per the registered PDD, the temperature meter shall be used based on the requirements, if applicable. During the monitoring period, the temperature meter was not used as the methane content is directly monitored by gas flow meter. |

| Data/parameter: | Pt |
|---|---|
| Data Unit | Pa |
| Description | Pressure of the gaseous stream in time interval t |
| Source of data to be used | Plant records |
| Value(s) of monitored parameter | Pressure meter is not used as methane content is directly monitored by gas flow meter /6/14/ |
| Monitoring equipment | As per the registered PDD, the pressure meter shall be used based on the requirements, if applicable. During the monitoring period, the pressure meter was not used as the methane content is directly monitored by gas flow meter. |
| Accuracy of the monitoring equipment | N/A |
| Calibration frequency/interval | N/A |
| Data Cross Checking: | N/A |

| | |
|---|---|
| Consistency as per the QA/QC defined in the methodology | N/A |
| Consistency as per the QA/QC established by the project participants in the PDD | N/A |
| Conclusion | As per the registered PDD, the pressure meter shall be used based on the requirements, if applicable. During the monitoring period, the pressure meter was not used as the methane content is directly monitored by gas flow meter. |

| **Data/parameter:** | **TDLi,y** |
|---|---|
| Data Unit | - |
| Description | Average technical transmission and distribution losses for providing electricity to source j in year y |
| Source of data to be used | Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ |
| Value(s) of monitored parameter | 0<br>The electricity is generated through the use of biogas in the biogas engines which are installed in the project activity. The electricity which is generated is utilized in the process of the project activity. The distance between the source of electricity generation and consumption is not very significant and hence there are no significant losses due to the transmission and distribution of the electricity in the project activity. The same was observed and confirmed through the physical on-site inspection and through the interviews of the relevant personnels available at the project site. Hence the default option (as per the Tool) has been applied to the project activity. Further it was also confirmed that the electricity is not imported from the grid for any purpose of the project activity. |
| Monitoring equipment | Not Applicable. The Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ has been used. |
| Accuracy of the monitoring equipment | Not Applicable. The Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ has been used. |
| Calibration frequency/interval | Not Applicable. The Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ has been used. |

| | |
|---|---|
| Data Cross Checking: | Not Applicable. The Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ has been used. |
| Consistency as per the QA/QC defined in the methodology | The Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ has been used. This is in line with requirements set out on applicable methodology. |
| Consistency as per the QA/QC established by the project participants in the PDD | The Default value as per "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption (version 01)*" /28/ has been used. This is in line with requirements set out on applicable methodology and the registered PDD. |
| Conclusion | The electricity is generated through the use of biogas in the biogas engines which are installed in the project activity. The electricity which is generated is utilized in the process of the project activity. The distance between the source of electricity generation and consumption is not very significant and hence there are no significant losses due to the transmission and distribution of the electricity in the project activity. The same was observed and confirmed through the physical on-site inspection and through the interviews of the relevant personnels available at the project site. Hence the default option (as per the Tool) has been applied to the project activity. Further it was also confirmed that the electricity is not imported from the grid for any purpose of the project activity.<br>The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. |

| **Data/parameter:** | **$BG_{burnt\ ,\ y}$** |
|---|---|
| Data Unit | $m^3$ |
| Description | Biogas volume in year y |
| Source of data to be used | Measurements undertaken using Gas flow meter and Plant Records /6/ |
| Value(s) of monitored parameter | The total volume of the Biogas burnt during the monitoring period by the project activity is 2424351 $m^3$. The biogas combusted in boiler is 1971508 $m^3$ and the biogas flared is 452843 $m^3$.<br><br>The project activity involves the treatment of 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 same was checked and confirmed during the site visit. |

<table>
<tr><td>Monitoring equipment</td><td>The total biogas generated through the treatment of the wastewater in the project activity. The total volumetric flow rate is measured as the sum of the measured flow rate of biogas for combustion in the boiler in palm oil mill (gas flow meter located on the boiler line) and measured flow rate of the excess biogas going for the flaring (gas flow meter located on the flare line).. The same was checked and confirmed during the site visit.<br><br>The biogas gaseous stream generated is bifurcated into two streams, one stream is directed to the boiler system for the combustion purpose and other stream is sent to the flare system installed as part of the project activity. Each of the gas streams are measured with the help of flow meters installed before the boiler and flare equipment installed under the project respectively.<br><br>The technical details of the installed meters are as follows:<br>Gas Flow meter for measuring the biogas sent to the Boiler
<table>
<tr><td>Make</td><td>Endress+Hauser</td></tr>
<tr><td>Type</td><td>PROWIRL 73 F3</td></tr>
<tr><td>Serial No</td><td>FB02D820000</td></tr>
<tr><td>Accuracy</td><td>±1.5 %</td></tr>
</table>
Gas Flow meter for measuring the biogas sent to the Flare system
<table>
<tr><td>Make</td><td>Endress+Hauser</td></tr>
<tr><td>Type</td><td>PROSONIC FLOW B 200 DN150 / 6"</td></tr>
<tr><td>Serial No</td><td>K508BF02000</td></tr>
<tr><td>Accuracy</td><td>±1.5 %</td></tr>
</table>
</td></tr>
<tr><td>Accuracy of the monitoring equipment</td><td>The accuracy of the meter is ±1.50 %, which is in compliance with the registered PDD /03/, and also in line with the national industrial standards.</td></tr>
<tr><td>Calibration frequency/interval</td><td>
<table>
<tr><td>Calibration frequency</td><td>Once in 3 years</td></tr>
<tr><td>Calibration date</td><td>11/08/2014</td></tr>
</table>
The calibration was conducted in line with the registered PDD and applicable to the monitoring period from 16/04/2015 to 30/04/2016
</td></tr>
<tr><td>Data Cross Checking:</td><td>The operational conditions of the monitoring equipment were assessed through interview during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br><br>The data is continuous monitored, hourly measured and monthly recorded. The measurements are undertaken by using the Gas Flowmeter. The volume flow measurement of the gas was verified through the review of monitoring records and interviews during the site visit.</td></tr>
<tr><td>Consistency as per the QA/QC defined in the methodology</td><td>It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The data is monitored continuously and hourly measurements are undertaken and this procedure is in line with requirements set out on applicable methodology.</td></tr>
</table>

| | |
|---|---|
| Consistency as per the QA/QC established by the project participants in the PDD | QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| Conclusion | The parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. The calibration procedures are also in line with the methodology and the registered PDD requirements. |

| **Data/parameter:** | $\eta_{flare,h}$ |
|---|---|
| Data Unit | Percentage |
| Description | Flare efficiency in hour h based on measurements or default values |
| Source o ata to be used | Based on default value given in methodology /27/ |
| Value(s) f monitored parameter | 0.5, if flare is detected in a minute.<br>0, otherwise<br>0 is used as no flare detector was installed at site during current monitoring period<br><br>It was observed that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs. |
| Monitoring equipment | N/A |
| Accuracy of the monitoring equipment | N/A |
| Calibration fr quency/interval | N/A |
| Data Cross Checking: | N/A |
| Consistency as per the QA/QC defined in the methodology | N/A |
| Consistency as per the QA/QC established by the project participants in the PDD | N/A |

| | |
|---|---|
| Conclusion | During the site visit, it was observed that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs. |

| **Data/parameter:** | **$S_{final,PJ,final}$** |
|---|---|
| Data Unit | Tonnes |
| Description | Amount of dry matter in final sludge |
| Source of data to be used | Onsite measurement |
| Value(s) of monitored parameter | Total Sludge generated is used for soil/land application, under aerobic conditions and hence not separately monitored.<br><br>The total final sludge which is generated from the project activity is used for soil/land application. During the site visit, the verification team visited the land area where the final sludge was applied as fertilizer. The same was also discussed with the relevant personnels available at the site area. It was confirmed that the sludge is used for the land application under aerobic conditions in the project activity.<br><br>As per the registered monitoring plan "*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*".<br><br>Hence the end-use of the final sludge is monitored which is the use of sludge for soil/land application. Hence the quantity of sludge is not separately measured/monitored. |
| Monitoring equipment | N/A |
| Accuracy of the monitoring equipment | N/A |
| Calibration frequency/interval | N/A |
| Data Cross Checking: | N/A |
| Consistency as per the QA/QC defined in the methodology | N/A |

| | |
|---|---|
| Consistency as per the QA/QC established by the project participants in the PDD | N/A |
| Conclusion | The total final sludge which is generated from the project activity is used for soil/land application. During the site visit, the verification team visited the land area where the final sludge was applied as fertilizer which was also discussed with the relevant personnels available at the site area. It was confirmed that the sludge is used for the land application under aerobic conditions.<br><br>As per the registered monitoring plan "*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*".<br><br>Hence the end-use of the final sludge is monitored which is the use of sludge for soil/land application. Hence the quantity of sludge is not separately measured. |

| **Data/parameter:** | $w_{CH4,y}$ |
|---|---|
| Data Unit | % |
| Description | Methane content in the biogas in year y |
| Source of data to be used | Onsite measurement using gas flow meter /7/14/ |
| Value(s) of monitored parameter | 71.77 |
| Monitoring equipment | There is no separate meter installed for measuring the methane content of the biogas which is generated in the project activity. The gas flow meter which is used to measure the total biogas generated is equally capable of measuring the methane content of the biogas as well. The same has been confirmed during the site visit and also cross-checked through the review of the gas flow meter manual. During the site visit, the it was noted that the gas flow meter also provided readings of the methane content directly. Hence the methane content in the biogas is directly measured which is in line with the registered PDD and applied methodology (AMS III. H, version 16) requirements. /10/<br>Make-Endress+Hauser<br>Type: PROWIRL 73 F3<br>Serial No. FB02D820000<br>Accuracy: ±1.5%<br>Calibration Frequency- once in 3 years<br>Date of calibration- 11/08/2014 |
| Accuracy of the monitoring equipment | The accuracy of the meter is ±2.0 %, which is in compliance with the registered PDD /01/, and also in line with the national industrial standards. |

| | | |
|---|---|---|
| | Calibration frequency/interval | <table><tr><td>Calibration frequency</td><td>Once in 3 years</td></tr><tr><td>Calibration date</td><td>11/08/2014</td></tr></table><br>The calibration was conducted in line with the registered PDD and applicable to the monitoring period from 16/04/2015 to 30/04/2016 |
| | Data Cross Checking: | The operational conditions of the monitoring equipment were assessed through interview during the site visit. In addition, it was verified procedure followed in order to verify the collect data collection and reporting.<br><br>The data is continuous monitored, daily measured and monthly recorded. The measurements are undertaken by using the meter. The measurement was verified through the review of monitoring records and interviews during the site visit. |
| | Consistency as per the QA/QC defined in the methodology | It was verified that PP fulfills the proposed QA/QC procedures on applicable methodology. The data is monitored continuously and daily measurements are undertaken and this procedure is in line with requirements set out on applicable methodology. |
| | Consistency as per the QA/QC established by the project participants in the PDD | QA/QC procedures taken by the project activity are in line with the proposed procedures on PDD as well as applicable methodology. |
| | Conclusion | There is no separate meter installed for measuring the methane content of the biogas which is generated in the project activity. The gas flow meter which is used to measure the total biogas generated is equally capable of measuring the methane content of the biogas as well. The same has been confirmed during the site visit and also cross-checked through the review of the gas flow meter manual.<br><br>Hence the parameter is correctly monitored according to the monitoring plan, the approved PDD and in accordance to the applied methodology. In addition, the provided information is consistent with the monitoring procedures and records available at the project site. The calibration procedures are also in line with the methodology and the registered PDD requirements. |
| **Findings** | CAR 01,CAR 03 and CAR 05 was raised which was successfully closed. For more information, please refer Appendix-4 of this report. | |
| **Conclusion** | The monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD. All the parameters were monitored and determined as per the registered monitoring plan. The DOE confirms through site visit verification, from the document review, the actual monitoring system complies with the registered monitoring plan. During the verification, all the relevant monitoring parameters of the registered monitoring plan have been verified with regard to the appropriateness of the verification method; the correctness of the values applied for ER calculation, the accuracy and applied QA/QC measures. It is confirmed that all the monitoring parameters have been measured/determined without material misstatements and are in line with all applicable standards and relevant requirements.<br><br>KBS confirms:<br>- That all the parameters stated in the registered PDD have been monitored except $\eta_{flare,h}$ (Flare efficiency) where it was observed that the that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating | |

| | |
|---|---|
| | project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs;<br>- The responsibilities and authorities for monitoring and reporting are in accordance with those stated in the registered PDD;<br>- The monitoring results are consistently recorded as per the approved frequency;<br>- Quality assurance and quality control procedure have been applied in accordance with the registered PDD |

### E.6.3. Implementation of sampling plan

| | |
|---|---|
| **Means of verification** | During the monitoring period, the COD levels (i.e. CODuntreated,y, CODtreated,y and CODww,discharge,y) is determined through 10 days campaign. The COD level has been used to determine the sample size for conducting the Representative Sampling. The sample size determination based on 10 days campaign is inline with the "Best Practice Examples Focusing on Sample Size and Reliability Calculations" (Annex-6, EB 67) and the registered PoA-DD & CPA-DD /3/.<br><br>Representative sample size is being taken to ensure the 90/10 confidence/precision level requirement. The sample size has been calculated based on the systematic sampling in line with the Section 2.3 (measurement in biogas projects) of the "*Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 04.0*".<br><br>The number of COD measurements that are required to meet the 90/10 reliability has been calculated with the following formula as follows as per the para 102 of the Sampling guideline.<br><br>n = (tn-1 x SD) / (0.1 x mean)<br><br>where<br><br>tn-1 is the value of the t-distribution /21/ for 90% confidence when the sample size is n. Since the sample size is not yet known, and so as a first step the value for 90% confidence when the sample is large, i.e. 1.645, has been used and then the calculation has been refined.<br><br><u>Sample Size calculation for COD inflow to digester</u><br>The mean value has been arrived as 72403 mg/L, while the standard deviation as 2620 mg/L as verified through the calculations available in the ERs Excelsheet.<br>As part of the first step, the sample size calculation at 90/10 confidence interval results into the following sample size.<br>$=[(1.645*2620)/(0.1*72403)]^2$ ~ 1 (rounded to integer)<br><br>The calculation has been repeated using the t-value for 90% confidence, which results into the following sample size.<br><br>$=[(6.314*2620)/(0.1*72403)]^2$ ~ 6 (rounded to integer)<br><br>The calculation is again repeated<br>$= [(2.015*2620)/(0.1*60776)]^2$ ~ 1 (rounded to integer)<br><br>The above process has been iterated and the sample size is again repeated as 1 or 6 or 1. Hence the sample size of 6 considered by PP has been considered as appropriate.<br><br><u>Sample Size calculation for COD outflow from digester</u><br>The mean value has been arrived as 19338 mg/L, while the standard deviation as 1618 mg/L as verified through the calculations available in the ERs Excelsheet.<br>As part of the first step, the sample size calculation at 90/10 confidence interval |

results into the following sample size.

$=[(1.645*1618)/(0.1*19338)]^2 \sim 2$ (rounded to integer)

The calculation has been repeated using the t-value for 90% confidence, which results into the following sample size.

$=[(6.314*1618)/(0.1*19338)]^2 \sim 28$ (rounded to integer)

The calculations are again repeated

$=[(1.703*1618)/(0.1*19338)]^2 \sim 3$ (rounded to integer)

The calculations are again repeated

$=[(2.92*1618)/(0.1*19338)]^2 \sim 6$ (rounded to integer)

The calculations are again repeated

$=[(2.015*1618)/(0.1*19338)]^2 \sim 3$ (rounded to integer)

The calculations are again repeated

$=[(2.92*1618)/(0.1*19338)]^2 \sim 6$ (rounded to integer)

The calculations are again repeated

$=[(2.015*1618)/(0.1*19338)]^2 \sim 3$ (rounded to integer)

The above process has been iterated and the sample size is again repeated as 6. Hence the sample size of 6 considered by PP has been considered as appropriate.

Sample Size calculation for COD discharge

The mean value has been arrived as 340 mg/L, while the standard deviation as 32 mg/L as verified through the calculations available in the ERs Excelsheet.

As part of the first step, the sample size calculation at 90/10 confidence interval results into the following sample size.

$=[(1.645*32)/(0.1*340)]^2 \sim 3$ (rounded to integer)

The calculation has been repeated using the t-value for 90% confidence, which results into the following sample size.

$=[(2.92*32)/(0.1*340)]^2 \sim 8$ (rounded to integer)

The calculations are again repeated

$=[(1.895*32)/(0.1*340)]^2 \sim 4$ (rounded to integer)

The calculations are again repeated

$=[(2.353*32)/(0.1*340)]^2 \sim 5$ (rounded to integer)

The calculations are again repeated

| | |
|---|---|
| | $=[(2.132*32)/(0.1*340)]^2$ ~ 5 (rounded to integer)<br><br>The calculations are again repeated<br><br>$=[(2.132*32)/(0.1*340)]^2$ ~ 5 (rounded to integer)<br><br>The above process has been iterated and the sample size is again repeated as 5. Hence the sample size of 5 considered by PP has been considered as appropriate.<br><br>The sample size arrived is 6 samples per year each for the COD inflow, 6 samples per year for the COD outflow from the digester and 5 samples per year for COD discharge. However the actual practice at the project site is to conduct daily or atleast weekly test, which is conservative.<br><br>Further the precision and reliability calculations of the sample size has further been confirmed inline with the guidance available in the Section 3 of the"*Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 04.0*".<br><br>The month-wise average of the COD level (inflow to digester, outflow from digester, COD discharge) has been determined, based on which standard deviation has been determined for each of the months during the monitoring period. The average standard deviation and mean value of COD inflow and COD outflow based on all the months have been calculated.<br>The standard error of mean COD inflow and outflow has been calculated based on the following formula in line with the Section 4.1 of the Sampling Guidance.<br><br>$((1-f)xs^2/n)^{1/2}$<br><br>Where f is the sampling fraction – the proportion of the population that is sampled.<br>$s^2$ is the sample variance (s is the sample standard deviation)<br>n is the sample size.<br><br>The precision associated with an estimate has been calculated as follows:<br>= t-value x standard error of the mean.<br><br>where the t-value depends on the level of confidence and size of the sample and the same has been derived through the Microsoft Excel using the TINV function. Based on the t-value arrived and standard error of the mean, the precision has been calculated for the COD inflow and outflow to/from digester.<br><br>The precision of COD inflow, COD outflow and COD discharge has been determined and found as 0.40%, 1.09% and 0.00% respectively. The same has been confirmed through the ERs Excelsheet and is inline with the "*Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 04.0*". Hence the precision has been found to be within the acceptable limits and hence the sample size has been found to be correct.<br><br>The sample size arrived is 6 samples per year each for the COD inflow, 6 samples per year for the COD outflow. The sample size arrived for the COD discharged is 5 samples per year. However the actual practice at the project site is to conduct daily or atleast weekly test, which is more accurate and leads to a conservative estimation. |
| **Findings** | CAR 04 was raised which was successfully closed. For more information, please refer Appendix-4 of this report. |
| **Conclusion** | Although the sampling size has been determined for estimating the number of tests to be conducted in year. The sample size arrived is 6 samples per year each for the COD inflow, 6 samples per year for the COD outflow. The sample size arrived for the COD discharged is 5 samples per year. However the actual practice followed is daily or atleast weekly test at the project site which is more conservative and |

| | |
|---|---|
| | accurate and hence found acceptable by the assessment team. |

## E.7. Compliance with the calibration frequency requirements for measuring instruments

| | |
|---|---|
| **Means of verification** | The monitoring period covers from 16/04/2015 to 30/04/2016. The calibration details and the frequency of the calibration are discussed above in section E.6.2. The meters, are calibrated as per the frequency requirements of the registered PDD and the applied methodology AMS III.H, version 16. |
| **Findings** | As discussed above in section E.6.2. Please refer to Appendix 4 for more details. CAR 01 is closed. |
| **Conclusion** | The calibration /9/10/11/12/ conducted for the equipments cover the monitoring period. Further the measuring equipments have been calibrated by the accredited agencies. This is consistent with the registered PDD and CDM VVS for project activities, version 02.0.<br><br>The verifier confirms that the calibration confirms the proper functioning of the monitoring equipment and is valid for the whole verification monitoring period. Further the verification team has checked calibration records to confirm that the frequency of calibration is carried out as specified in the registered monitoring plan |

## E.8. Assessment of data and calculation of emission reductions or net removals

### E.8.1. Calculation of baseline GHG emissions or baseline net GHG removals by sinks

| | |
|---|---|
| **Means of verification** | As per the registered PDD and paragraph 18 of AMS-III.H (Version 16), baseline emissions are calculated as follows:<br><br>$BEy = \{BE_{power,y} + BE_{ww,treatment,y} + BE_{s,treatment,y} + BE_{ww,discharge,y} + BE_{s,final,y}\}$<br><br>where,<br>$BE_{power,y}$ = Emissions on account of electricity or fossil fuel used<br>$BE_{ww,treatment,y}$ = Methane emissions from baseline wastewater treatment systems<br>$BE_{s,treatment,y}$ = Methane emissions from baseline sludge treatment system.<br>$BE_{ww,discharge,y}$ = Methane emissions on account of inefficiencies in the baseline wastewater treatment systems and presence of biodegradable organic carbon in untreated wastewater discharged to sea / river / lake<br>$BE_{s,final,y}$ = Methane emissions from the decay of the final sludge generated by baseline treatment system<br><br>The baseline emissions due to $BE_{power,y}$, $BE_{s,treatment,y}$, $BE_{ww,discharge,y}$, $BE_{s,final,y}$ are not applicable as per the registered PDD. Further the PP has considered them as zero during the monitoring period and the same is the conservative estimation of baseline emissions.<br><br>Therefore, the baseline emission is simplified as follow:<br>$BE_y = BE_{ww,treatment,y}$<br><br><u>Baseline emissions from wastewater treatment system</u><br>$BE_{ww,treatment,y} = \Sigma(Q_{ww,i,y} * COD_{untreated,i,y} * \eta_{COD,BL,i} * MCF_{ww,treatment,BL,i}) * B_{o,ww} * UF_{BL} * GWP_{CH_4}$<br><br>where:<br><br>$Q_{ww,i,y}$ : Volume of wastewater treated in baseline wastewater treatment system i in year y which is affected by the project activity (m3/year)<br><br>$COD_{untreated,i,y}$ : Chemical Oxygen Demand of the wastewater inflow to the baseline treatment system i in year y (tonnes/m3)<br><br>$\eta_{COD,BL,i}$ : COD removal efficiency of the baseline treatment system i, determined as per the paragraphs 26, 27 or 28 of AMS-III.H version 16 |

$MCF_{ww,treatment,BL,i}$ : Methane correction factor for the baseline wastewater treatment system i (MCF value is obtained from Table III.H.1 in AMS-III.H version 16)

$B_{o,ww}$ : Methane producing capacity of the wastewater (kg CH4/kg COD)

$UF_{BL}$ : Model correction factor to account for model uncertainties

$GWP_{CH4}$ Global warming potential for methane

| Parameters | Value | Source |
|---|---|---|
| $B_{o,ww}$ | 0.25 kg $CH_4$/kgCOD | Value as per AMS-III.H (version 16) /27/ paragraph 20. The same is discussed above under Section B.6.1. |
| $COD_{untreated,i,y}$ | 0.086705 tCOD/$m^3$ | Average value over current monitoring period i.e. 16/04/2015 to 30/04/2016. The same has been verified through the monitoring records /5/ and through the interviews during the site visit. |
| $\eta_{COD,BL,i}$ | 85 % | Designed value as per manufacturer specification established in line with paragraph 28 (2) (b) of AMS-III.H version 16 /27/. The same is discussed above under Section B.6.1. |
| $Q_{ww,i,y}$ | 90691 $m^3$ | Total wastewater treated during current monitoring period i.e. 16/04/2015 to 30/04/2016. The same has been verified through the monitoring records /6/ and through the interviews during the site visit. |
| $MCF_{ww,treatment,BL,i}$ | 0.8 | IPCC value as per Table III.H.1 in AMS-III.H version 16 /27/. 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. The same is discussed above under Section B.6.1. |
| $UF_{BL}$ | 0.89 | Value as per AMS-III.H (version 16) paragraph 20 /27/. The same is discussed above under Section B.6.1. |
| $GWP_{CH4}$ | 25 | IPCC default value /20/. The same is discussed above under Section B.6.1. |

$BE_{ww,treatment,y}$ = 90691* (0.086705*85%*0.8)*0.25*0.89*25
= 29,743.28 $tCO_2e$

$BE_y = BE_{ww,treatment,y}$
= 29,743 $tCO_2e$ (rounded down)

The verification team checked the emission reduction calculations sheets and confirm that equations used have been correctly applied and as per the applied methodology AMS III.H, version 16 /27/. The same was also cross checked with the registered PDD, applied methodology and found to be in order.

| | |
|---|---|
| **Findings** | Not Applicable |
| **Conclusion** | KBS confirm that baseline emissions have been appropriately calculated and are consistent with site visit observations, the applied methodology, registered PDD and the validation report. |

### E.8.2. Calculation of project GHG emissions or actual net anthropogenic GHG removals by sinks

| | |
|---|---|
| **Means of verification** | As per the registered PDD and paragraph 29 of AMS-III.H (Version 16), the project |

activity emissions from the systems affected by the project activity is calculated as follows:

$PE_y = PE_{power,y} + PE_{ww,treatment,y} + PE_{s,treatment,y} + PE_{ww,discharge,y} + PE_{s,final,y} + PE_{fugitive,y} + PE_{biomass,y} + PE_{flaring,y}$

$PE_{power,y}$ = Emissions from electricity or fuel consumption in the year y
$PE_{ww,treatment,y}$ = Methane emissions from wastewater treatment systems affected by the project activity, and not equipped with biogas recovery, in year y
$PE_{s,treatment,y}$ = Methane emissions from sludge treatment systems affected by the project activity, and not equipped with biogas recovery, in year y
$PE_{ww,discharge,y}$ = Methane emissions from degradable organic in treated wastewater in year y
$PE_{s,final,y}$ = Methane emissions from anaerobic decay of the final sludge produced in year y
$PE_{fugitive,y}$ = Methane emissions from biogas release in capture systems in year y
$PE_{biomass,y}$ = Methane emissions from biomass storage under anaerobic conditions
$PE_{flaring,y}$ = Methane emissions due to incomplete flaring in year y

The project emissions due to PEww,treatment,y, PEs,treatment,y, PEs,final,y, PEbiomass,y are considered as not applicable and hence zero which is in line with the registered PDD. The same was also confirmed at the time of site visit.

The project emissions due to PEpower,y, PEww,discharge,y, PEfugitive,y, PEflaring,y has been considered as per the below calculations:

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

Project emissions calculations due to electricity consumption ($PE_{EC,y} = PE_{power,y}$):
The project emissions on account of electricity consumption in the project activity has been calculated as per "Tool to calculate baseline, project and/or leakage emission from electricity consumption". The project activity falls under Scenario-B of the Tool, i.e. Electricity consumption from an off-grid fossil fuel fired captive power plant.

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

Project emissions from the treated wastewater discharged
The project emissions from the treated wastewater discharge is calculated as follows:

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

Project emissions from biogas release in capture system
The project emissions from biogas release in capture system is calculated as follows:

$MEP_{ww,treatment,y} = Q_{ww,i,y,} * B_{o,ww} * UF_{PJ} * COD_{removed,PJ,k,y} * MCF_{ww,treatment,PJ,k}$
$= 90691*0.25*1.12* 0.065451*0.8$
$= 1329.63$ tonnes $CH_4$

$PE_{fugitive,ww,y} = (1 - CFE_{ww}) * MEP_{ww,treatment,y} * GWP_{CH4}$
$= (1 - 0.9) * 1329.63 * 25$
$= 3324.08\ tCO_2e$

$PE_{fugitive,y} = PE_{fugitive,ww,y} = 3324.08\ tCO_2e$

| | |
|---|---|
| | Project emissions due to incomplete flaring<br>The project emissions due to incomplete flaring is calculated as follows:<br><br>$PE_{flaring,y} = F_{CH4,RG,m} * (1-\eta_{Flare,m}) * \rho_{CH4} * 10^{-3} * GWP_{CH4}$<br><br>Where,<br><br>$F_{CH4,RG,m}$ = 452843 $m^3$<br>$\eta_{Flare,m}$ = 0<br>$\rho_{CH4}$ =0.716 $tCH_4/m^3$<br>$GW_{CH4}$= 25<br><br>$PE_{flaring,y}$= 5817.53 $tCO_2e$<br><br>The total project emissions are as follows:<br>$PE_y = PE_{power,y} + PE_{fugitive,y} + PE_{flaring,y} + PE_{ww,discharge,y}$<br><br>$PE_y$ =18.59 +22.219 +3324.08 + 5817.53<br><br>$PE_y$ =9182.41 $tCO_2e$<br><br>$PE_y$ =9,183 $tCO_2e$ (rounded up) |
| **Findings** | CAR 02 and 05 was raised which was successfully closed. For more information, please refer Appendix-4 of this report. |
| **Conclusion** | KBS confirms that the project emissions have been appropriately calculated and are consistent with site visit observations, the applied methodology, registered PDD and the validation report. |

### E.8.3. Calculation of leakage GHG emissions

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|---|---|
| **Means of verification** | The leakage emissions have to be considered only when energy generating equipment is transferred from another activity. Since the project activity employs a new set of equipment, leakage emissions is neglected, which is as per the registered PDD and the applied methodology AMS III.H, version 16 /27/. |
| **Findings** | Not Applicable |
| **Conclusion** | Not Applicable |

### E.8.4. Summary calculation of GHG emission reductions or net anthropogenic GHG removals by sinks

| | |
|---|---|
| **Means of verification** | The emission reduction ERy by the proposed project activity during the crediting period is the difference between baseline emissions BEy, project emissions PEy and emissions due to leakage Ly.<br><br>Since project activity is identified as option 1(f) as per AMS-III.H version 16, emission reductions are estimated ex-post based on the lowest value of the following:<br><br>According to paragraph 33 of AMS-III.H version 16, for case 1(f), ex-post emission reductions shall bebased on the lowest value as per the following equation (paragraph 34 of AMS-III.H version 16):<br>$ER_{y, ex\ post} = \min((BE_{y, ex\ post} - PE_{y, ex\ post} - LE_{y,ex\ post}), (MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post}))$<br><br>Where,<br>$MD_y = BG_{burnt,y} * w_{CH4,y} * D_{CH4} * FE * GWP_{CH4}$<br><br>$BG_{burnt,y}$ Annual volume of biogas burnt in year y (m3)<br>$w_{CH4,y}$Methane content of the biogas in the year y (volume fraction)<br>$D_{CH4}$ Density of methane at the temperature and pressure of the biogas in the year y (t/m3) |

| | |
|---|---|
| | FE Flare efficiency in year y (fraction). If the biogas is combusted for gainful purposes, e.g. fed to an engine, an efficiency of 100% will be applied<br><br>Parameter \| Value \| Unit \| Source<br>$\eta_{flare}$ \| 0.5 \| -- \| default value as conservative<br>$BG_{burnt,y}$ \| 2424351 \| $m^3$ \| Measured during the monitoring period<br>$fv_{CH4,RG,h}/w_{CH4,y}$ \| 71.77 % \| -- \| Measured during the monitoring period<br>$\rho_{CH4,n}/D_{CH4}$ \| 0.716 \| \| IPCC default value<br>$GWP_{CH4}$ \| 25 \| -- \| Default value<br><br>$MD_y$ =(2424351*71.77%*0.716*0.5*25)/1000<br><br>$MD_y$ =15572.44 $tCO_2e$<br><br>Hence<br>$ER_{y, ex\ post}$ = min (($BE_{y, ex\ post} - PE_{y, ex\ post} - LE_{y,ex\ post}$), ($MD_y - PE_{power,y} - PE_{biomass,y} - LE_{y,ex\ post}$))<br><br>$ER_{y, ex\ post}$ = min ((20560, (15572.44-18.59)<br><br>$ER_{y, ex\ post}$ =15553 $tCO_2e$<br><br>The verification team concludes that the project emissions, baseline emissions, leakage and emission reductions stated in the PDD are appropriate and as per the methodology and the GHG calculations are complete and transparent, and their accuracy has been verified. |
| **Findings** | CAR 05 was raised which was successfully closed. For more information, please refer Appendix-4 of this report. |
| **Conclusion** | The data presented in the monitoring report and emission reduction worksheet were assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment. Sufficient evidences were presented and verified by KBS for the reported emission reductions as listed above<br><br>KBS confirms:<br>- All the data and parameters were monitored in accordance with the registered PDD;<br>- The data presented in the monitoring report were assessed by reviewing in detail project documentation, collection of monitored data, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment.<br>- The calculation of emission reductions have been carried out in accordance with the formulae and methods described in the registered PDD, the applied methodology and methodological tools;<br><br>Emission factor and default values have been applied in the calculation in accordance to the registered PDD |

### E.8.5. Comparison of actual GHG emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

| | |
|---|---|
| **Means of verification** | The actual values achieved during this monitoring period is 15,553 t $CO_2e$ /2/, while the values estimated in ex ante calculation of registered PDD is 60167 $tCO_2e$ |
| **Findings** | Not Applicable |
| **Conclusion** | There is a decrease of 74.15% from the estimated ERs (as per the registered PDD) during this monitoring period. |

### E.8.6. Remarks on difference from estimated value in registered PDD

| | |
|---|---|
| **Means of verification** | The actual values achieved during this monitoring period is 15,553 t $CO_2e$ /2/, while the values estimated in ex ante calculation of registered PDD is 60167 $tCO_2e$. |

| | |
|---|---|
| | Hence there is a decrease of 74.15% from the estimated ERs (as per the registered PDD) during this monitoring period.<br>The palm oil mill was not operational at full load resulting lower value of POME, which is main input to project activity. Further as flare efficiency has been considered as zero has also increased project emission. |
| **Findings** | Not Applicable |
| **Conclusion** | The decrease in the emission reductions are due the reason that the palm oil mill was not operational at full load resulting lower value of POME, which is main input to project activity. Further as flare efficiency has been considered as zero has also increased project emission. Hence the reasons for the decrease in the emission reductions have been clearly provided in the monitoring report. |

### E.8.7. Actual GHG emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

| | | |
|---|---|---|
| **Means of verification** | 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 |
| | Not Applicable | 15553 $tCO_2e$ |
| **Findings** | CAR 05 was raised which was successfully closed. For more information, please refer Appendix-4 of this report. | |
| **Conclusion** | The actual monitoring period does not fall into the first commitment period. | |

### E.9. Assessment of reported sustainable development co-benefits

| | |
|---|---|
| **Means of verification** | N/A |
| **Findings** | N/A |
| **Conclusion** | N/A |

### E.10. Global stakeholder consultation

| | |
|---|---|
| **Means of verification** | No comments were received |
| **Findings** | No comments were received |
| **Conclusion** | No comments were received |

## SECTION F. Internal quality control

>>

The draft verification report prepared by team leader is reviewed by an independent technical reviewer (having competence of relevant technical area himself/herself or through an independent technical area expert) to confirm the internal procedures established by KBS are duly followed and the verification report/opinion is reached in an objective manner and complies with the applicable CDM requirements.

The independent technical reviewer may approve or reject the draft verification report. The findings may be identified even at this stage, which needs to be satisfactorily resolved, before the request for issuance is submitted to UNFCCC. The final decision is taken by the Manager (Technical and Certification). The technical reviewer and Manager (Technical & Certification) can be same person.

The final decision is authorized by Managing Director, KBS once the report is approved by the Manager (Technical & Certification).

## SECTION G. Verification opinion

>>

The verification team confirms that the evidence is of sufficient quantity, appropriate quality and reliable. The reported values, notation, units and sources in the monitoring report for all the monitoring parameters have been cross checked with the emission reduction sheet and registered PDD. During the course of verification and on site visit, the data submitted by CDM PP was cross verified with log books, monitoring records generated during the monitoring period for the project activity. The procedure for data monitoring, recording, transfer and compilation was also verified and found in compliance with the monitoring plan as mentioned in the registered PDD.

Evidences (Documents/interview/site visit) referred for verification of individual monitoring parameter and fixed parameters are defined in main section of report. It is confirmed by the assessment team that the reported emission reductions have been conservatively calculated. A list of referred documents for verification is also included in Appendix 3 of this report.

Based on the information seen and evaluated we confirm that the implementation of the project has resulted in 15,553 $tCO_2e$ emission reductions during period from 16/04/2015 to 30/04/2016.

## SECTION H. Certification statement

>>

KBS Certification Services Pvt. Ltd. has been contracted by 'PT Umbul Mas Wisesa' to undertake independent verification and certification for the greenhouse gas (GHG) emission reductions reported from the "Biogas recovery from wastewater treatment in PT. Umbul Mas Wisesa Palm Oil Mill", UNFCCC Ref. No.9197 for the monitoring period 16/04/2015 to 30/04/2016 in the Monitoring Report Version 01 (first version) dated 31/05/2016.

The verification is based on the registered PDD and the monitoring report for this project. Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakech accord, as well as those defined by the CDM Executive Board.

The management of the PT Umbul Mas Wisesa is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project final Monitoring Report Version 06 dated 04/04/2019. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of the PT Umbul Mas Wisesa. The development and maintenance of records and reporting procedures are in accordance with the Monitoring Report Version 06 dated 04/04/2019.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the monitoring period from 16/04/2015 to 30/04/2016 (including both the days) based on the reported emission reductions in the final Monitoring Report Version 06 dated 04/04/2019 covered for the same period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

KBS confirms the following;

Reporting period: From 16/04/2015 to 30/04/2016 (including both the days)

Verified and certified emission in the above reporting period:

| | Amount | Unit |
|---|---|---|
| Baseline emissions (BE) | 15,553 | $tCO_2e$ |
| Project emissions (PE) | 0 | $tCO_2e$ |
| Leakage emissions (LE) | 0 | $tCO_2e$ |
| Certified emission reductions (CERs) | 15,553 | $tCO_2e$ |

# Appendix 1. Abbreviations

| Abbreviations | Full texts |
|---|---|
| AMS | Approved Methodology Small Scale |
| BE | Baseline Emissions |
| CAR | Corrective Action Request |
| CDM | Clean Development Mechanism |
| CDM AS | CDM Accreditation Standard |
| CDM EB | CDM Executive Board |
| CEF | Carbon Emission Factor |
| CERs | Certified Emission Reductions |
| CH4 | Methane |
| CL | Clarification Request |
| CO2e | Carbon dioxide equivalent |
| COP | Conference of Parties |
| DNA | Designated National Authority |
| DOE | Designated Operational Entity |
| EF | Emission Factor |
| EI | External Individuals |
| ERs | Emission Reductions |
| FAR | Forward Action Request |
| GHGs | Greenhouse Gas(es) |
| GWP | Global Warming Potential |
| ISO | International Organization of Standardization |
| IPCC | Intergovernmental Panel on Climate Change |
| IR | Internal Resource |
| JMR | Joint Meter Readings |
| KP | Kyoto Protocol |
| kWh | Kilo Watt Hour |
| LE | Leakage Emissions |
| MR | Monitoring Report |
| MP | Monitoring Plan |
| MW | Mega Watt |
| MWh | Mega Watt Hour |
| O & M | Operation and Maintenance |
| PE | Project Emissions |
| PDD | Project Design Document |
| PS | Project Standard for project activities |
| PCP | Project Cycle Procedure for project activities |
| QA/QC | Quality Assurance/Quality Control |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VVS | Validation & Verification Standard for project activities |

# Appendix 2. Competence of team members and technical reviewers

| | |
|---|---|
| **Personnel Name:** | **Sanjay Kandari** |

| **Qualified to work as:** | | | |
|---|---|---|---|
| Team Leader | ☒ | Technical Expert | ☒ |
| Validator/Verifier | ☒ | Financial Expert | ☒ |
| Technical Reviewer | ☒ | Local Expert (India) | ☒ |
| **Area(s) of Technical Expertise** | | | |
| **Sectoral Scope** | **Technical Area** | | |
| Energy Industries (renewable/non-renewable sources) | TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar | | |
| Energy industries (renewable/non-renewable sources) | TA 1.2: Energy generation from renewable energy sources | | |
| Energy demand | TA 3.1. Energy Demand | | |
| Waste Handling and Disposal | TA 13.1 Waste Handling and Disposal<br>TA 13.2 Manure | | |
| Approved by (Manager C & T) | Akhilesh Joshi | | |
| Approval date: | 11/12/2015 | | |

| **Personnel Name:** | **Rohit Badaya** | | |
|---|---|---|---|
| **Qualified to work as:** | | | |
| Team Leader | ☒ | Technical Expert | ☒ |
| Validator/Verifier | ☒ | Financial Expert | ☒ |
| Technical Reviewer | ☒ | Local Expert (India) | ☒ |
| **Area(s) of Technical Expertise** | | | |
| **Sectoral Scope** | **Technical Area** | | |
| Energy Industries (renewable/non-renewable sources) | TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar | | |
| Energy industries (renewable/non-renewable sources) | TA 1.2: Energy generation from renewable energy sources | | |
| Energy demand | TA 3.1. Energy Demand | | |
| Waste Handling and Disposal | TA 13.1 Solid waste and wastewater<br>TA 13.2 Manure | | |
| Approved by | Manager Competency & Training | | |
| Approval date: | 16/10/2017 | | |

| **Personnel Name:** | **M.P. Kanal** | | |
|---|---|---|---|
| **Qualified to work as:** | | | |
| Team Leader | ☒ | Technical Expert | ☒ |
| Validator/Verifier | ☒ | Financial Expert | ☐ |
| Technical Reviewer | ☒ | Local Expert (India) | ☒ |
| **Area(s) of Technical Expertise** | | | |
| **Sectoral Scope** | **Technical Area** | | |
| Energy industries (renewable/non-renewable sources) | TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar<br>TA 1.2: Energy generation from renewable energy sources | | |
| Energy demand | TA 3.1. Energy Demand | | |
| Waste Handling and Disposal | TA 13.1 Waste Handling and Disposal | | |
| Agriculture | TA 15.1 Agriculture | | |
| Approved by (Manager C & T) | Sanjay Kandari | | |
| Approval date: | 02/08/2017 | | |

| Personnel Name: | | Chetan Swaroop Sharma | |
|---|---|---|---|
| **Qualified to work as:** | | | |
| Team Leader | ☒ | Technical Expert | ☒ |
| Validator/Verifier | ☒ | Financial Expert | ☒ |
| Technical Reviewer | ☒ | Local Expert (India) | ☒ |
| **Area(s) of Technical Expertise** | | | |
| **Sectoral Scope** | **Technical Area** | | |
| Energy industries (renewable/non-renewable sources) | TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar | | |
| | TA 1.2: Energy generation from renewable energy sources | | |
| Energy Demand | TA 3.1. Energy demand | | |
| Waste handling and disposal | TA 13.1. Solid waste and wastewater<br>TA 13.2. Manure | | |
| Approved by (Manager C & T) | Sanjay Kandari | | |
| Approval date: | 01/05/2017 | | |

# Appendix 3. Documents reviewed or referenced

| No. | Author | Title | References to the document | Provider |
|---|---|---|---|---|
| 1 | PP | Monitoring Report webhosted on the UNFCCC website (version 01)<br><br>Monitoring Report (final version 06) | Dated 31/05/2016<br><br>Dated 04/04/2019 | PP |
| 2 | PP | Emission reduction calculations provided in the form of spread sheet (version 01)<br><br>Emission reduction calculations provided in the form of spread sheet (version 06) | Dated 31/05/2016<br><br>Dated 04/04/2019 | PP |
| 3 | PP | PDD for the project activity titled "Biogas recovery from wastewater treatment in PT. Umbul Mas Wisesa Palm Oil Mill" | Version 08<br>Dated 27/03/2015 | PP |
| 4 | SIRIM QAS International | Validation report for the project activity titled "Biogas recovery from wastewater treatment in PT. Umbul Mas Wisesa Palm Oil Mill" | Version 04<br>Dated 15/04/2015 | UNFCCC website |
| 5 | PT Umbul Mas Wisesa | Plant log sheets on COD analysed for the period 16/04/2015 to 30/04/2016 | - | PP |
| 6 | PT Umbul Mas Wisesa | Plant log sheets for LFM and GM for the period 16/04/2015 to 30/04/2016 | - | PP |
| 7 | PT Umbul Mas Wisesa | Plant log sheets for methane content for the period 16/04/2015 to 30/04/2016 | - | PP |

| | | | | |
|---|---|---|---|---|
| 8 | PT Umbul Mas Wisesa | Electricity consumption readings for the period 16/04/2015 to 30/04/2016 | - | PP |
| 9 | Endress + Hauser | Calibration Certificates for serial number FB02E020000 (FM) | Dated 20/08/2014 | PP |
| 10 | Endress + Hauser | Calibration Certificates for serial number FB02D820000 (GM) | Dated 11/08/2014 | PP |
| 11 | Schneider Electric | Calibration Certificates for serial number 34170811203 (EM) | Dated 01/04/2015 | PP |
| 12 | Endress + Hauser | Calibration Certificates for serial number K508BF02000 (FM) | Dated 11/08/2014 | PP |
| 13 | KBS | Site visit carried out for the project activity<br>• Audit Plan<br>• Attendance sheet & Interviews | - | KBS |
| 14 | Equipment supplier | Technical Specifications of the equipments installed under the project activity<br><br>Manual/Technical information for the Liquid Flowmeter<br><br>Manual/Technical information for the Gas Flowmeter<br><br>Manual for the COD Colorimeter | - | PP |
| 15 | Gubernur Sumatera Utara | Consent for the project activity | Dated 10/07/2013 | PP |
| 16 | - | Biogas Plant Commissioning Certificate | - | PP |
| 17 | Endress + Hauser | Biogas Flow Meter Manual | - | PP |
| 18 | Endress + Hauser | Wastewater Flow Meter Manual | - | PP |
| 19 | PP | Wastewater Analysis summary for the monitoring period | - | PP |
| 20 | IPCC | IPCC Assessment Report | | Others |
| 21 | CDM Executive Board | CDM-MR-Form | Version 06.0 | UNFCCC Website |
| 22 | CDM Executive Board | CDM-MR-Form filling guidelines | Version 06.0 | UNFCCC Website |
| 23 | CDM Executive Board | CDM project standard for project activities | Version 02.0 | UNFCCC Website |
| 24 | CDM Executive Board | CDM validation and verification standard for project activities | Version 02.0 | UNFCCC Website |
| 25 | CDM Executive Board | CDM project cycle procedure for project activities | Version 02.0 | UNFCCC Website |
| 26 | CDM Executive Board | Sampling and surveys for CDM project activities and programme of activities<br><br>Best Practice Examples Focusing on Sample Size and Reliability Calculations", | Version 04.1<br><br>(Annex-6, EB 67) | UNFCCC Website |
| 27 | CDM Executive Board | AMS III.H. (Methane recovery in wastewater treatment) | Version 16.0 | UNFCCC Website |
| 28 | CDM Executive Board | General guidelines for SSC CDM methodologies<br><br>Project emissions from flaring<br><br>Tool to calculate baseline, project and-or leakage emissions from | Version 20.0<br><br>Version 02.0 | UNFCCC Website |

| | | | | |
|---|---|---|---|---|
| | | electricity consumption | Version 01 | |

# Appendix 4. Clarification requests, corrective action requests and forward action requests

**Table 1. Remaining FAR from validation and/or previous verifications**

| ~~**FAR ID**~~ | ~~xx~~ | ~~**Section no.**~~ | ~~E.2~~ | ~~**Date:** DD/MM/YYYY~~ |
|---|---|---|---|---|
| ~~**Description of FAR**~~ | | | | |
| | | | | |
| ~~**Project participant response**~~ | | | | ~~**Date:** DD/MM/YYYY~~ |
| | | | | |
| ~~**Documentation provided by project participant**~~ | | | | |
| | | | | |
| ~~**DOE assessment**~~ | | | | ~~**Date:** DD/MM/YYYY~~ |
| | | | | |

**Table 2. CL from this verification**

| **CL ID** | 01 | **Section no.** | - | **Date:** 30/11/2016 |
|---|---|---|---|---|
| **Description of CL** | | | | |
| Following documents needs to be submitted to verify the various requirements of VVS:<br>a) Documents to verify the project implementation in accordance with CPA DD such as commissioning certificate, technical specifications of key equipment etc.<br>b) COD test reports pertaining to inflow and outflow of effluent.<br>c) Copy of environmental consents for the monitoring period.<br>d) Copy of technical specifications of monitoring equipment.<br>e) Copy of calibration for all monitoring equipment. | | | | |
| **Project participant response** | | | | **Date:** 20/06/2017 |
| All supportive provided along with this response. | | | | |
| **Documentation provided by project participant** | | | | |
| a) Commissioning certificate<br>b) COD test report internal logbook<br>c) Sample logbook<br>d) Technical specification<br>*e)* Calibration report | | | | |
| **DOE assessment** | | | | **Date:** 27/07/2017 |
| All the supporting documents have not been provided to the DOE for review. PP is requested to provide the remaining documents (calibration reports) for the project activity.<br><br>The issue is open. | | | | |
| **Project participant response** | | | | **Date:** 12/12/2017 |
| The calibration reports provided with this response. | | | | |
| **Documentation provided by project participant** | | | | |
| Calibration report | | | | |
| **DOE assessment** | | | | **Date:** 05/01/2018 |
| The Calibration reports have now been submitted to the assessment team. The issue is closed. | | | | |

**Table 3. CAR from this verification**

| **CAR ID** | 01 | **Section no.** | Section D.2 | **Date:** 30/11/2016 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| The details filled in section D.2 of published MR for the monitoring equipment used is incomplete and doesn't comply with the requirement of MR filling guidance. | | | | |
| **Project participant response** | | | | **Date:** 20/06/2017 |
| Section G.2 is revised as per MR completion guidelines. | | | | |
| **Documentation provided by project participant** | | | | |

| |
|---|
| MR V02 |
| **DOE assessment** **Date:** 27/07/2017 |
| The complete details are not provided in the revised MR. PP is requested to include the details including the make, type, serial number, accuracy class, calibration details of the installed equipments in the MR. The issue is open. |
| **Project participant response** **Date:** 12/12/2017 |
| Section G.2 is revised as per MR completion guidelines. |
| **Documentation provided by project participant** |
| MR V02 |
| **DOE assessment** **Date:** 05/01/2018 |
| The complete details as per the issue raised above is still not traceable in the revised Monitoring report. Hence complete details shall be included in the revised monitoring report.<br>Hence the issue remains open. |
| **Project participant response** **Date:** 20/03/2018 |
| The correct details provided in the MR |
| **Documentation provided by project participant** |
| MR V02 |
| **DOE assessment** **Date:** 17/04/2018 |
| The serial number of the wastewater flow meter and gas flow meter does not matches with the supporting documents submitted to the assessment team.<br>Hence the issue remains open. |
| **Project participant response** **Date:** 05/07/2018 |
| |
| **Documentation provided by project participant** |
| MR V02 |
| **DOE assessment** **Date:** 06/07/2018 |
| The corrections have been provided in the MR and found correct. The issue is closed. |

| | | | | |
|---|---|---|---|---|
| **CAR ID** | 02 | **Section no.** | ERs Excelsheet | **Date:** 30/11/2016 |
| **Description of CAR** | | | | |
| The submit ER sheet does not include all the monitoring parameters. E.g the parameters pertaining to 'Project emission calculation' from flare are not included. (Refer the UNFCCC completeness checklist). | | | | |
| **Project participant response** | | | | **Date:** 20/06/2017 |
| The flare detection system was not installed during current monitoring period, the hours of flare provide by PP was estimated value. In revised ER sheet and MR the same has been corrected and total biogas sent for flare is considered as project emission. The project emission is incorporated in ER sheet. | | | | |
| **Documentation provided by project participant** | | | | |
| MR V02<br>ER sheet V02 | | | | |
| **DOE assessment** | | | | **Date:** 27/07/2017 |
| The corrections have been provided in the MR and ERs sheet and found correct. The issue is closed. | | | | |

| | | | | |
|---|---|---|---|---|
| **CAR ID** | 03 | **Section no.** | - | **Date:** 30/11/2016 |
| **Description of CAR** | | | | |
| During the site visit, it was observed that the flare detector was not installed at the site, which was part of the monitoring plan. Hence PP shall clarify as how the project has followed the monitoring plan during the monitoring period. | | | | |
| **Project participant response** | | | | **Date:** 20/06/2017 |
| The MR is revised. | | | | |
| **Documentation provided by project participant** | | | | |
| MR | | | | |
| **DOE assessment** | | | | **Date:** 27/07/2017 |
| During the site visit, it was observed that the flare detection system was not installed during the current monitoring period. Hence the PP has considered the flare efficiency as zero for calculating project emissions due to flaring, which is a conservative approach. This is a temporary deviation from the registered monitoring plan as per the registered PDD. Hence a separate request for post-registration changes is being submitted together with this submission of this request for issuance of CERs. CAR 03 was raised during the verification process which was successfully closed. Hence the issue is now closed. | | | | |

| CAR ID | 04 | Section no. | - | Date: 05/01/2018 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| The PP shall include details and calculations related to the sample size determined through the 10 days measurement campaign in the MR and the Excelsheet. | | | | |
| **Project participant response** | | | | **Date:** 20/03/2018 |
| The details included in the revised MR and Excelsheet | | | | |
| **Documentation provided by project participant** | | | | |
| MR | | | | |
| **DOE assessment** | | | | **Date:** 17/04/2018 |
| The details on the sample size calculations have not been provided for the COD of wastewater discharge to sea/river from the project activity. The issue is open. | | | | |
| **Project participant response** | | | | **Date:** 05/07/2018 |
| The details included in the revised MR and Excelsheet | | | | |
| **Documentation provided by project participant** | | | | |
| MR | | | | |
| **DOE assessment** | | | | **Date:** 06/07/2018 |
| The complete details on the sample size calculations have now been provided in the revised MR. The issue is closed. | | | | |

| CAR ID | 05 | Section no. | - | Date: 05/01/2018 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| 1. The actual and estimated emission reductions provided in the Section E.5 of the MR does not matches with the Excelsheet. PP is requested to correct and revise the emission reductions in the MR.<br>2. The value for the Flare efficiency not indicated in the table under Section D.2 of the MR. | | | | |
| **Project participant response** | | | | **Date:** 20/03/2018 |
| 1. The Monitoring report is revised.<br>2. The Flare detector was not installed during the monitoring period. It is indicated in the MR. | | | | |
| **Documentation provided by project participant** | | | | |
| MR | | | | |
| **DOE assessment** | | | | **Date:** 17/04/2018 |
| 1. The estimated and actual emission reductions are corrected in the revised Monitoring report. The issue is closed.<br>2. It is Ok that the Flare detector was not installed during the monitoring period, but the value needs to be indicated in the MR. The issue is open. | | | | |
| **Project participant response** | | | | **Date:** 05/07/2018 |
| The details included in the revised MR and Excelsheet | | | | |
| **Documentation provided by project participant** | | | | |
| MR | | | | |
| **DOE assessment** | | | | **Date:** 06/07/2018 |
| 1. The complete details on the sample size calculations have now been provided in the revised MR. The issue is closed.<br>2. The value of zero which is used in the calculations is indicated in the revised MR. The issue is closed. | | | | |

| CAR ID | 06 | Section no. | Regarding incomplete issues raised by UNFCCC secretariat (received 1st time) | Date: 03/10/2018 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| 1: For monitoring parameter BGburt,y (i.e. Biogas volume in year y), page 20 of AMS III.H version 16 requires reporting both values if the biogas streams flared and utilized are monitored separately. The diagram in page 5 of monitoring report indicates two streams of biogas (i.e. one flared and the other one sent to boiler). However, the equipment (i.e. Serial No. K508BF02000) reported under parameter BGburt,y in page 17-18 of the monitoring report implies an usage of one gas flow meter only. The DOE is requested to clarify: (1) the usage(s) of biogas recovered; (2) gas flow meter(s) used to measure biogas and the location(s); (c) the volume values of each biogas stream. | | | | |

2: To determine the chemical oxygen demand of the wastewater before and after the treatment system, sampling approaches were applied. Page 18 of AMS III.H version 16 requires 90/10 confidence/precision level. However, the achieved precisions are not reported. The DOE shall provide information on how it has verified this compliance.

3: Page 19 of AMS III.H version 16 requires monitoring the end-use of the final sludge, since the project activity claims that the project sludge is sent for land application under aerobic condition. However, the DOE did not provide information on how it has verified and confirmed the final usage of project sludge.

4: In measuring parameter WCH4,y (i.e. Methane content in the biogas), page 20 of AMS III.H requires measurement using equipment that can directly measure methane content in the biogas (i.e. the estimation of methane content of biogas based on measurement of other constituents of biogas such as CO2 is not permitted). However, the DOE did not provide information on how it has verified and confirmed that the equipment used has measured methane content directly.

5: To determine project emissions from electricity consumption, parameter TDLi,y (Average technical transmission and distribution losses for providing electricity) is considered as zero, since it is the default value of option B.2 (i.e. the electricity consumption source is the project activity) as per "Tool to calculate baseline, project and/or leakage emission from electricity consumption". However, the did not provide information on how it has verified and confirmed the electricity consumption source of the project activity.

| **Project participant response** | **Date:** 18/01/2019 |
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1. The residual gas stream is monitored for boiler line and flare line, the same is indicated in registered PDD and Monitoring report as actual practice. The $BG_{burt,y}$ is summation of both the stream of biogas, the explanation in MR was not very clear, the same has been incorporated in revised MR. The project is implemented and operated in line with registered PDD, now both the meter details provided under $BG_{burnt,y}$ parameter, as both stream monitored, it is in compliance with applied methodology.
2. The reliability check for sampling confidence/precision level achieved during current monitoring period is calculated in ER sheet COD sample work book and the results has been incorporated in revised MR.
3. The same has been detailed to DOE during site visit, where the PP has shown the site for land application of sludge generated from the project in palm cultivation field.
4. The Gas flow meter employed by the project activity is capable of monitoring the methane content in biogas stream, the values reported is taken from the gas flow meter. The technical specification of gas flow meter is provided as supportive, which confirms the same.
5. The PP has steam based turbine at project site, wherein the source of fuel to boiler is biogas generated from the project activity, the same is used for generation of steam and electricity, however in emergency or when boiler is not operational the PP generate the electricity from DG installed as backup source, the electricity shown for project emission calculation is generated from DG set, as the source of electricity is at project site only the transmission and distribution losses in comparison to grid supply are negligible, hence same is considered as zero which is appropriate. The same was discussed onsite and verified by DOE.

**Documentation provided by project participant**

Revised MR Version-05

| **DOE assessment** | **Date:** 15/02/2019 |
|---|---|

1. PP has now clarified on the two biogas streams generated in the project activity. The total biogas generated is through the treatment of the wastewater in the project activity. The total volumetric flow rate is measured as the sum of the measured flow rate of biogas for combustion in the boiler in palm oil mill and measured flow rate of the excess biogas going for the flaring. The same was checked and confirmed during the site visit.

The total biogas generated through the treatment of the wastewater in the project activity. The total volumetric flow rate is measured as the sum of the measured flow rate of biogas for combustion in the boiler in palm oil mill (gas flow meter located on the boiler line) and measured flow rate of the excess biogas going for the flaring (gas flow meter located on the flare line).. The same was checked and confirmed during the site visit.

The biogas gaseous stream generated is bifurcated into two streams, one stream is directed to the boiler system for the combustion purpose and other stream is sent to the flare system installed as part of the project activity. Each of the gas streams are measured with the help of flow meters installed before the boiler and flare equipment installed under the project respectively.

The technical details of the installed meters for measuring both the “Gas Flow meter for measuring the biogas sent to the Boiler” and “Gas Flow meter for measuring the biogas sent to the Flare system” has been provided in the MR and found correct. Further the volume of each of the biogas streams have been provided in the MR.
The information on the same has also been included in the Verification report. Hence the issue is closed.

2. The sampling approach has been applied for determine the chemical oxygen demand of the wastewater before and after the treatment system. During the monitoring period, the COD levels (i.e. CODuntreated,y, CODtreated,y and CODww,discharge,y) is determined through 10 days campaign. The COD level has been used to determine the sample size for conducting the Representative Sampling. The sample size determination based on 10 days campaign is inline with the “Best Practice Examples Focusing on Sample Size and Reliability Calculations” (Annex-6, EB 67) and the registered PoA-DD & CPA-DD /3/.

Representative sample size is being taken to ensure the 90/10 confidence/precision level requirement. The sample size has been calculated based on the systematic sampling in line with the Section 2.3 (measurement in biogas projects) of the “*Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 04.0*”.

The number of COD measurements that are required to meet the 90/10 reliability has been calculated with the following formula as follows as per the para 102 of the Sampling guideline.

n = (tn-1 x SD) / (0.1 x mean)

where

tn-1 is the value of the t-distribution /21/ for 90% confidence when the sample size is n. Since the sample size is not yet known, and so as a first step the value for the 90% confidence when the sample is large, i.e. 1.645, has been used and then the calculation has been refined.

Sample Size calculation for COD inflow to digester
The mean value has been arrived as 72403 mg/L, while the standard deviation as 2620 as verified through the calculations available in the ERs Excelsheet.
As part of the first step, the sample size calculation at 90/10 confidence interval results into the following sample size.
$=[(1.645*2620)/(0.1*72403)]^2 \sim 1$ (rounded to integer)

The calculation has been repeated using the t-value for 90% confidence, which results into the corresponding sample sizes. The above process has been iterated and the sample size is again repeated as 1 or 6 or 1. Hence the sample size of 6 considered by PP has been considered as appropriate.

Sample Size calculation for COD outflow from digester
The mean value has been arrived as 19338 mg/L, while the standard deviation as 1618 as verified through the calculations available in the ERs Excelsheet.
As part of the first step, the sample size calculation at 90/10 confidence interval results into the following sample size.

$=[(1.645*1618)/(0.1*19338)]^2 \sim 2$ (rounded to integer)

The calculation has been repeated using the t-value for 90% confidence, which results into the corresponding sample sizes. The above process has been iterated and the sample size is again repeated as 6. Hence the sample size of 6 considered by PP has been considered as appropriate.

Sample Size calculation for COD discharge
The mean value has been arrived as 340 mg/L, while the standard deviation as 32 as verified through the calculations available in the ERs Excelsheet.
As part of the first step, the sample size calculation at 90/10 confidence interval results into the following sample size.

$=[(1.645*32)/(0.1*340)]^2 \sim 3$ (rounded to integer)

The calculation has been repeated using the t-value for 90% confidence, which results into the following sample size. The above process has been iterated and the sample size is again repeated as 5. Hence the

sample size of 5 considered by PP has been considered as appropriate.

The sample size arrived is 6 samples per year each for the COD inflow, 6 samples per year for the COD outflow from the digester and 5 samples per year for COD discharge. However the actual practice at the project site is to conduct daily or atleast weekly test, which is conservative.

Further the precision and reliability calculations of the sample size has further been confirmed inline with the guidance available in the Section 3 of the"*Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 04.0*".

The month-wise average of the COD level (inflow to digester, outflow from digester, COD discharge) has been determined, based on which standard deviation has been determined for each of the months during the monitoring period. The average standard deviation and mean value of COD inflow and COD outflow based on all the months have been calculated.
The standard error of mean COD inflow and outflow has been calculated based on the following formula in line with the Section 4.1 of the Sampling Guidance.

$((1-f)xs^2/n)^{1/2}$

Where f is the sampling fraction – the proportion of the population that is sampled.
$s^2$ is the sample variance (s is the sample standard deviation)
n is the sample size.

The precision associated with an estimate has been calculated as follows:
= t-value x standard error of the mean.

where the t-value depends on the level of confidence and size of the sample and the same has been derived through the Microsoft Excel using the TINV function. Based on the t-value arrived and standard error of the mean, the precision has been calculated for the COD inflow and outflow to/from digester.

The precision of COD inflow, COD outflow and COD discharge has been determined and found as 0.41%, 1.10% and 0.00% respectively. The same has been confirmed through the ERs Excelsheet and is inline with the "*Guideline: Sampling and surveys for CDM project activities and programmes of activities, version 04.0*". Hence the precision has been found to be within the acceptable limits and hence the sample size has been found to be correct.

The sample size arrived is 6 samples per year each for the COD inflow, 6 samples per year for the COD outflow. The sample size arrived for the COD discharged is 5 samples per year. However the actual practice at the project site is to conduct daily or atleast weekly test, which is more accurate and leads to a conservative estimation. The information on the same has also been included in the Verification report. Hence the issue is closed.

3. The end-use of the final sludge is monitored which is the use of sludge for soil/land application (under aerobic conditions) and hence the quantity of sludge is not separately measured/monitored. During the site visit, the verification team visited the land area where the final sludge was applied as fertilizer. The same was also discussed with the relevant personnels available at the site area. It was confirmed that the sludge is used for the land application under aerobic conditions in the project activity. The information on the same has also been included in the Verification report. Hence the issue is closed.

4. There is no separate meter installed for measuring the methane content of the biogas which is generated in the project activity. The gas flow meter which is used to measure the total biogas generated is equally capable of measuring the methane content of the biogas as well. The same has been confirmed during the site visit and also cross-checked through the review of the gas flow meter manual. During the site visit, the it was noted that the gas flow meter also provided readings of the methane content directly. Hence the methane content in the biogas is directly measured which is in line with the registered PDD and applied methodology (AMS III. H, version 16) requirements. The information on the same has also been included in the Verification report. Hence the issue is closed.

5. The electricity is generated through the use of biogas in the biogas engines which are installed in the project activity. The electricity which is generated is utilized in the process of the project activity. The distance between the source of electricity generation and consumption is not very significant and hence there are no significant losses due to the transmission and distribution of the electricity in the project activity. The same was observed and confirmed through the physical on-site inspection and through the interviews of

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| the relevant personnels available at the project site. Hence the default option (as per the Tool) has been applied to the project activity. Further it was also confirmed that the electricity is not imported from the grid for any purpose of the project activity. The information on the same has also been included in the Verification report. Hence the issue is closed. |

| **CAR ID** | 07 | **Section no.** | Regarding incomplete issues raised by UNFCCC secretariat (received 2nd time) | **Date:** 04/04/2019 |
|---|---|---|---|---|
| **Description of CAR** | | | | |
| 1: How the value of parameter CODremoved,PJ,k,y (i.e. 0.063937 t/m3, the chemical oxygen demand removed by the treatment system) is derived is not traceable in the ER sheet (column E in tab "Input values"). In addition, it is noted that these values applied in calculating the project emission are not matching values calculated as per methodology requirement (i.e. difference between the inflow COD and the outflow COD). Please refer to footnote 10 of AMS III.H version 16.<br><br>2: The formula to calculate PEflaring,y (project emissions due to incomplete flaring) in page 23 of the monitoring report does not result in the reported value (i.e. 5817.53 tCO2e). | | | | |
| **Project participant response** | | | | **Date:** 04/04/2019 |
| 1. There was error due to change in first and last month value as per last comment, which was not updated as formula was missing the same has been corrected in revised ER sheet, further the revised COD removed value is applied to calculated project emission where relevant. The total emission reduction is same as previous submission.<br><br>2. The ER sheet has applied formula correctly for calculation of project emission due to flaring, however there was typo error in MR wherein density parameter was missing the same has been incorporated the value of project emission due to flaring is same. | | | | |
| **Documentation provided by project participant** | | | | |
| Revised MR | | | | |
| **DOE assessment** | | | | **Date:** 04/04/2019 |
| 1. The PP has now indicated the formula for the calculations of the parameter (CODremoved,PJ,k,y) in the revised ERs excelsheet. Further the formula is in line with the requirements of the footnote 10 of the applied methodology (AMS III.H version 16). Hence the issue is closed.<br><br>2. The formula in the Monitoring Report has been corrected and the corrections are inline with the formula as described in the ERs Excelsheet. The same is also found to be inline with the applied methodology and hence the issue is closed. | | | | |

**Table 4. FAR from this verification**

| ~~**FAR ID**~~ | ~~xx~~ | ~~**Section No.**~~ | | ~~**Date:** DD/MM/YYYY~~ |
|---|---|---|---|---|
| ~~**Description of FAR**~~ | | | | |
| | | | | |
| ~~**Project participant response**~~ | | | | ~~**Date:** DD/MM/YYYY~~ |
| | | | | |
| ~~**Documentation provided by project participant**~~ | | | | |
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| ~~**DOE assessment**~~ | | | | ~~**Date:** DD/MM/YYYY~~ |
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## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 02.1 | 11 January 2018 | Editorial revision to correct the numbering of appendices in the instructions. |
| 02.0 | 31 October 2017 | Revision to align with the requirements of the "CDM validation and verification standard for project activities" (version 01.0). |
| 01.0 | 23 March 2015 | Initial publication. |

Decision Class: Regulatory
Document Type: Form
Business Function: Issuance
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