Revised Monitoring Plan

For

Methane recovery from waste water generated from wheat straw wash at Paper manufacturing unit of Shreyans Industries Limited (SIL)

Version 1.5

Project Participant

Shreyans Industries Limited (SIL)
UNFCCC Ref No. 0935

Date: 08/02/2011

SECTION D. Application of a monitoring methodology and plan:

>>

D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

>>

Title: “Monitoring Methodology for Methane Recovery from Waste Water” Type. III.H.

Reference: Monitoring plan for the project activity has been prepared according to the guidelines given in paragraph 8, 9, 10 and 11 of Type.III.H. simplified baseline and monitoring methodology.

Monitoring plan for the project activity includes flow of waste water entering buffer tank, inlet COD, Outlet COD and fraction of methane in recovered (fuelled/flared) biogas in the project activity.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

>>

This project activity falls under Type –III “other project activities” and category H “ Methane recovery” as specified in indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories.

The project activity, installation of high rate UASB reactor reduces both emissions by sources by recovering methane and directly emits less than 15 kilo tons of carbon di oxide equivalent per year. It is also proved above in section A.4.5.that project activity of SIL is not a debundled component of large project activity thus qualify under the above mentioned project type and category.

D.3. Data to be monitored:

>>

Data to be monitored for calculating project and Baseline emissions

Sl. No.	Data variable	Data unit	Source of data	Measured (m), calculated (c), estimated (e),	Recording frequency	How will the data be archived? (electronic / paper)	Comment
D.3.1	Flow rate of waste straw wash	M^3/day	Plant	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations

D.3.2	COD (inlet)	mg/litre	Lab	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.3	COD (outlet)	mg/litre	Lab	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.4	Electricity consumption	kWh	Plant	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.5	Temperature of Gas	°C	Plant	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.6	Pressure of Gas	Kg/cm^2	Plant	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.7	Volume of Biogas Fuelled	Nm^3/day	Plant	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.8	Quantity of Biogas fulled	Tons	Plant	C	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.9	Methane Quantity fuelled	Tons	Plant	C	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.10	Volume of Biogas Flared	Nm^3/day	Plant	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations
D.3.11	Fraction of methane in biogas fuelled/ flared	%	Lab	M	Daily	CP+2Yr. Paper	Baseline Emission Calculations

The flare employed in the project activity is an open flare system. According to the methodological tool "*Tool to determine project emissions from flaring gases containing methane*", Annex 13, EB 28, page 2,

"*In case of open flares, the flare efficiency cannot be measured in a reliable manner (i.e. external air will be mixed and will dilute the remaining methane) and a default value of 50% is to be used provided that it can be demonstrated that the flare is operational (e.g. through a flame detection system reporting electronically on continuous basis). If the flare is not operational the default value to be adopted for flare efficiency is 0%.*"

For the project activity, the flare efficiency will be taken as 0%, and hence, monitoring for continuous operation of the flare system is not required, because, the flare in the project activity is negligibly small, as the total gas generated in the project activity is utilized in two boilers out of which at least one is continuously in operation. Also, monitoring whether the gas flared is burnt properly or not is not feasible. Hence, continuous monitoring of the flare efficiency is not possible. However, to be on the conservative side, the flare efficiency in the project activity is assumed to be zero, and the entire flared gas would be subtracted from the gas generated to calculate gas fueled in the project activity and the same would be utilized for calculation of CER generated.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

>>

Quality control (QC) and quality assurance (QA) procedures would be undertaken for data to be monitored. (data items in tables contained in section D.3 (a to b) above, as applicable)

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.3.1	Low	Yes	Flow rate measurement is essential for calculation of both baseline and project emissions. Flow meter complying with standards is used for monitoring. The volume of waste water treated is recorded on a daily basis and reported in the plant records/log books. The calibration of the flow meter used is done annually in order to ensure the highest levels of accuracy in the measurement.
D.3.2	Medium	Yes	COD (Inlet) is a measure of methane generation potential of untreated waste water and is essential for calculating both baseline and project emissions. Analysis is done in laboratory for measurement on a daily basis at the plant location and reported in the plant records/log books. Standard procedure is used for measurement. The monitoring equipments and procedure used for measuring the parameter is tested half yearly by a third party in order to ensure the highest level of accuracy in the monitoring procedure.

D.3.3	Medium	Yes	COD (outlet) is a measure of methane generation potential of treated waste water from digester and is essential for calculating project emissions. Analysis is done in laboratory for measurement on a daily basis at the plant location and reported in the plant records/log books. Standard procedure is for measurement. The monitoring equipments and procedure used for measuring the parameter is tested half yearly by a third party in order to ensure the highest level of accuracy in the monitoring procedure.
D.3.4	Low	Yes	Electricity consumption is measured by meters provided at plant and the same would be reported in the plant records/log books. The monitoring equipment used for measuring the parameter is calibrated annually in order to ensure the highest level of accuracy in the monitoring process.
D.3.5	Low	Yes	Temperature of gas is measured for calculating the weight of biogas produced. The Gas Flow Meter has a provision to measure the temperature and the same is reported in the plant records/log books. The Gas Flow Meter used to measure the temperature is calibrated annually to ensure the highest level of accuracy in the monitoring.
D.3.6	Low	Yes	Pressure of gas is measured for calculating the weight of biogas produced. The Gas Flow Meter has a provision to measure the pressure and the same is reported in the plant records/log books. The Gas Flow Meter used to measure the pressure is calibrated annually to ensure the highest level of accuracy in

			the monitoring.
D.3.7	Low	Yes	Volume of gas is measured for calculating the weight of biogas produced. The volume of the gas is monitored with the flow meter installed at the plant location and the same is reported in the plant records/log books. The flow meter is calibrated annually to ensure the highest level of accuracy in the monitoring.
D.3.8	Medium	No	Quantity of biogas fuelled is computed from its volume and density (which is calculated from its temperature and pressure conditions) and the same is reported in the plant records/log books.
D.3.9	Medium	Yes	Methane quantity is computed from the fraction of methane present in Biogas. Methane fraction is measured in laboratory with the gas chromatograph installed at the plant location and the same reported in the plant records/log books. There is provision to check fraction of methane at both fuelling and flaring stage as lines of both these points are connected to the gas chromatograph Meter. The gas chromatograph is calibrated annually to ensure the highest level of accuracy in the monitoring. Moreover, the statistical analysis on 95% confidence level will be carried out for the periodic monitoring of the methane fraction.
D.3.10	Low	Yes	Volume of gas flared is measured for calculating volume of biogas generated. The volume of the gas is monitored with the flow meter installed at the plant location and the same is reported in the plant records/log books. The flow meter is calibrated annually to ensure the highest level of accuracy in the monitoring.
D.3.11	Low	Yes	Fraction of methane

			fuelled/flared is measured for calculating the weight of methane fuelled/flared. Methane fraction is measured with the gas chromatograph installed at the plant location and the same would be reported in the plant records/log books. There is provision to check fraction of methane at both fuelling and flaring stage as lines of both these points are connected to the gas chromatograph Meter. The gas chromatograph is calibrated annually to ensure the highest level of accuracy in the monitoring. Moreover, the statistical analysis on 95% confidence level will be carried out for the periodic monitoring of the methane fraction

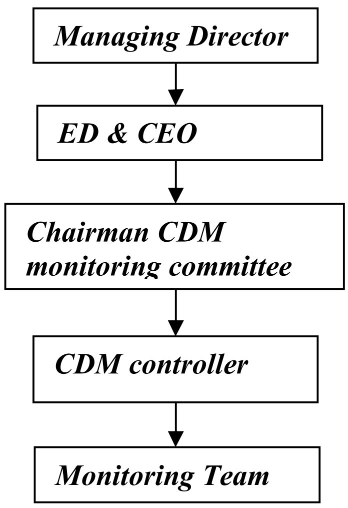
D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

>>

SIL has planned an operation and management structure for the project activity with roles and responsibilities of individuals defined. The management would be responsible for monitoring and reporting of the parameters involved. All parameters would be monitored and reported in a transparent manner so that they can be easily verified by DOE.

SIL constituted a CDM monitoring team which would be responsible for the overall monitoring and management of the projects. CDM team comprises of monitoring supervisors having responsibility of operating and monitoring the plant. Parameters involved in the project activity are monitored.

Daily report of the parameters monitored would be reported to *CDM controller*. Chairman CDM monitoring committee would be the in charge of CDM cell and report to ED & CEO who would review the reports on monthly basis and subsequently send reports to the Managing Director. Management structure for monitoring and reporting is presented in following block diagram.

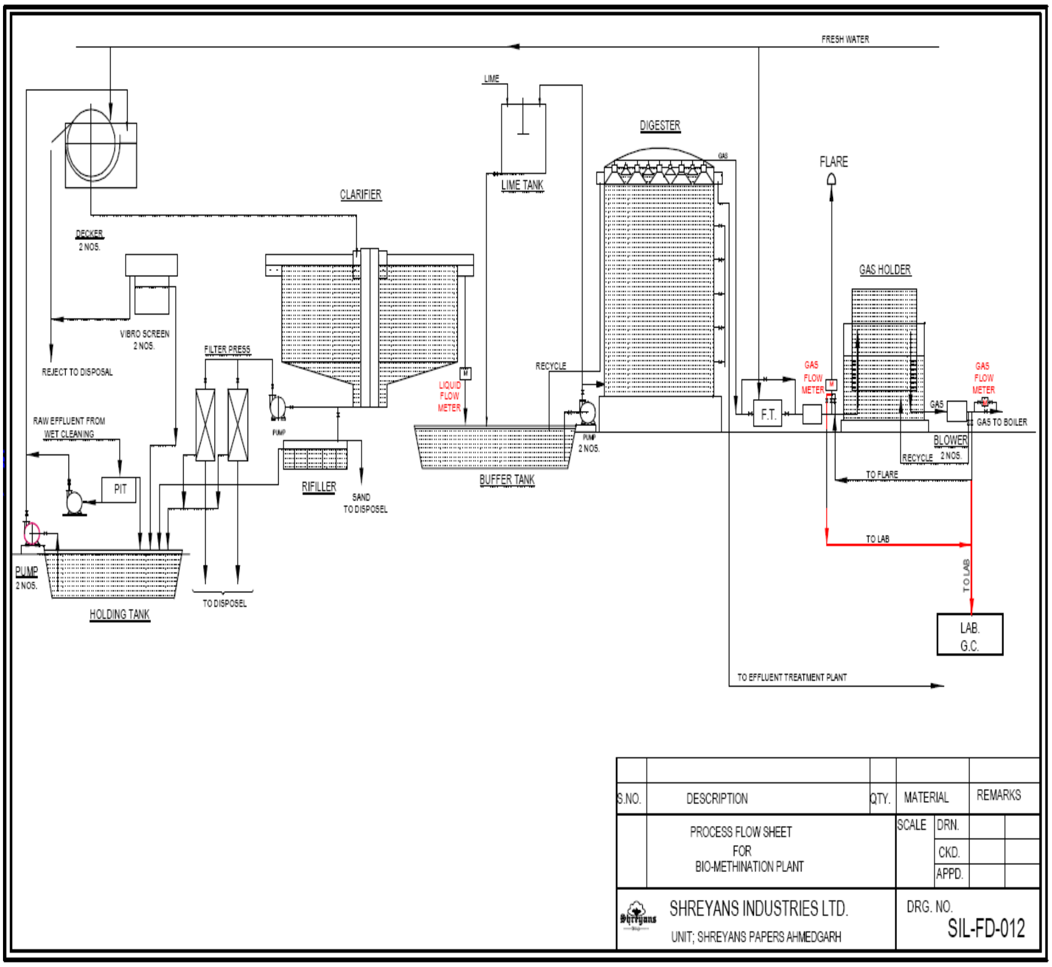


D.6. Name of person/entity determining the monitoring methodology:

>>

The monitoring methodology was prepared by Shreyans Industries Limited whose contact information is given in annexure-1. SIL is the project participant for this project activity.

Line Diagram for Meter Positioning



SECTION E.: Estimation of GHG emissions by sources:

>>

E.1. Formulae used:

>>

E.1.1 Selected formulae as provided in appendix B:

>>

GHG emission reduction for the project activity has been calculated using following formula

$ER_y = BE_y - PE_y$ – Leakages

Where

ER_y = emission reductions in year 'y'

BE_y = Baseline emissions

PE_y = Emissions due to project activity in year 'y'

E.1.2 Description of formulae when not provided in appendix B:

>>

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

>>

GHG emissions due to the project activity within the project boundary include direct emissions from the following sources.

(i) CO_2 emissions related to the power used by the project activity facilities.

Emission factors for grid electricity or diesel fuel use as the case may be shall be calculated as described in category I.D.

(ii) Methane emissions through inefficiency of the wastewater treatment and presence of degradable organic carbon in treated wastewater.

(iii) Methane emissions from the decay of the final sludge generated by the treatment systems.

(iv) Methane fugitive emissions through inefficiencies in capture and flare systems.

(v) Methane emissions resulting from dissolved methane in the treated wastewater effluent.

$$\mathbf{PE_y = PE_{y,\,power} + PE_{y,ww,treated} + PE_{y,s,final} + PE_{y,fugitive} + PE_{y,dissolved}}$$

where:

PE_y: project activity emissions in the year "y" (tonnes of CO_2 equivalent)

$PE_{y,power}$: emissions through electricity or diesel consumption in the year "y"

$PE_{y,ww,treated}$: emissions through degradable organic carbon in treated wastewater in year "y"

$PE_{y,s,final}$: emissions through anaerobic decay of the final sludge produced in the year "y". If the sludge is controlled combusted, disposed in a landfill with methane recovery, or used for soil application, this term can be neglected, and the destiny of the final sludge will be monitored during the crediting period.

PEy,fugitive: emissions through methane release in capture and flare systems in year "y".

PEy,dissolved: emissions through dissolved methane in treated wastewater in year "y"

$PE_{y, power}$ = EF*EC

Where:

EF[1] = Emission factor calculated tons of CO_2/GwH

EC = Electricity consumed per year in Million Kwh.

$PE_{y, power}$ = 896 X 0.235 = 211 tons

PEy,ww,treated = Qy,ww * CODy,ww,treated * Bo,ww * MCFww * GWP_CH4

where:

Qy,ww: volume of wastewater treated in the year "y" (m3)

CODy,ww,treated: chemical oxygen demand of the treated wastewater in the year "y" (tonnes/m3)

Bo,ww: methane generation capacity of the treated wastewater (IPCC default value of 0.25 kg CH_4/kg.COD)

MCFww,treated: methane conversion factor for the anaerobic decay of wastewater. (default value of 0.5 is suggested)[2]

GWP_CH_4 Global Warming Potential for CH_4 (value of 21 is used)

PEy,ww,treated = 700000 X 0.0026 X 0.25 X 0.5 X 21 = 4778 tons

$PE_{y,s,final} = S_{y,final} * DOC_{y,s,final} * DOCF * F * 16/12 * GWP\_CH_4$

where:

$PE_{y,s,final}$: Methane emissions from the anaerobic decay of the final sludge generated in the wastewater system in the year "y" (tonnes of CO2 equivalent)

$S_{y,final}$: Amount of final sludge generated by the wastewater treatment in the year y (tonnes).

$DOC_{y,s,final}$: Degradable organic content of the final sludge generated by the wastewater treatment in the year y (mass fraction). It can be measured by sampling and analysis of the sludge produced, or the IPCC default value for solid wastes of 0.3 is used.

DOCF: Fraction of DOC dissimilated to biogas (IPCC default value is 0.77).

F: Fraction of CH_4 in landfill gas (IPCC default is 0.5).

PEy,s,final = 0 tons

$PE_{y,fugitive} = PE_{y,fugitive,ww} + PE_{y,fugitive,s}$

where:

$PE_{y,fugitive,ww}$ Fugitive emissions through capture and flare inefficiencies in the anaerobic wastewater treatment in the year "y" (tonnes of CO_2 equivalent)

---

[1] Refer emission factor calculation for northern regional grid in Appendix-A.

[2] IPCC default values are 1.0 for anaerobic, and zero for aerobic systems. Here it is assumed that after the discharge of the wastewater to a river, lake, sea, etc., half of the degradable organic carbon will decay anaerobically.

$PE_{y,fugitive,s}$ Fugitive emissions through capture and flare inefficiencies in the anaerobic sludge treatment in the year "y" (tonnes of CO_2 equivalent)

$$PE_{y,fugitive,ww} = (1 – CFE_{ww}) * ME_{y,ww,untreated} * GWP\_CH_4$$

where:

CFE_{ww} capture and flare efficiency of the methane recovery and combustion equipment in the wastewater treatment (a default value of 0.9 shall be used, given no other appropriate value)

$ME_{y,ww,untreated}$ methane emission potential of the untreated wastewater in the year "y" (tonnes)

$$ME_{y,ww,untreated} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,untreated}$$

where:

$COD_{y,ww,untreated}$ Chemical oxygen demand of the wastewater entering the anaerobic treatment reactor/system with methane capture in the year "y" (tonnes/m_3)

$MCF_{ww,untreated}$ methane conversion factor for the anaerobic decay of the untreated wastewater (IPCC default value of 1.0 for anaerobic systems. If the untreated wastewater is discharged to the environment, the default value of 0.5 is suggested).

$ME_{y,ww,untreated}$ = 700000 X 0.007 X 0.25 X 1 = 1225 tons

$PE_{y,fugitive,ww}$ = (1-0.9) X 1225 X 21 = 2573 tons

$$PE_{y,dissolved} = Q_{y,ww} * [CH_4]_{y,ww,treated} * GWP\_CH_4$$

where:

$[CH_4]_{y,ww,treated}$ dissolved methane content in the treated wastewater (tonnes/m_3). In aerobic wastewater treatment default value is zero, in anaerobic treatment it can be measured, or a default value of 10e-4 tonnes/m^3 can be used.

$PE_{y,dissolved}$ = 700000 X 10e-4 X 21 = 1470 tons

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

>>

There is no transfer of equipments involved in SIL project activity hence leakages are not considered.

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

>>

Project activity emissions[3] = **9031 tons of CO_2e equivalent per annum**

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

>>

Baseline emissions for the project activity include methane generation emission potential of untreated wastewater and or sludge.

$$BE_y = ME_{y,ww,untreated} + ME_{y,s,untreated}$$

Where:

BE_y = Baseline emissions in year 'y'

$ME_{y,ww,untreated}$: Methane generation potential of untreated wastewater 'y'

$ME_{y,s,untreated}$: Methane generation potential of untreated sludge 'y'

$$ME_{y,ww,untreated} = Q_{y,ww} * COD_{y,ww,untreated} * B_{o,ww} * MCF_{ww,untreated} * GWP\_CH_4$$

where:

$COD_{y,ww,untreated}$: Chemical oxygen demand of the wastewater entering the anaerobic treatment reactor/system with methane capture in the year "y" (tonnes/m_3)

$MCF_{ww,untreated}$: methane conversion factor for the anaerobic decay of the untreated wastewater (IPCC default value of 1.0 for anaerobic systems. If the untreated wastewater is discharged to the environment, the default value of 0.5 is suggested).

$ME_{y,ww,untreated}$ = 700000 X 0.007 X 0.21 X 1 X 21 = 21609 tons

$ME_{y,s,untreated}$ methane emission potential of the untreated sludge in the year "y" (tonnes)

$$ME_{y,s,untreated} = S_{y,untreated} * DOC_{y,s,untreated} * DOC_F * F * 16/12$$

where:

$S_{y,untreated}$ amount of untreated sludge generated in the year "y" (tonnes)

$DOC_{y,s,untreated}$ Degradable organic content of the untreated sludge generated in the year y (mass fraction). It can be measured by sampling and analysis of the sludge produced, or the IPCC default value for solid wastes of 0.3 is used.

$ME_{y,s,untreated}$ = 0

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

>>

Emission reduction = Baseline emissions – Project emissions

Baseline emissions = 21,609 tons CO2 equivalent per annum

[3] Refer CER Calculation sheet for details of Project emissions

Project emissions = 9,031 tons CO2 equivalent per annum

Emission reduction = 21,609 – 9,031

= 12,578tons CO2 equivalent per annum

E.2 Table providing values obtained when applying formulae above:

Year	Baseline emissions (tonnes of CO_2)	Project emissions (tonnes of CO_2)	Leakages (tonnes of CO_2)	Emission reductions (tonnes of CO_2)
2007-2008	21,609	9,031	0	12,578
2008-2009	21,609	9,031	0	12,578
2009-2010	21,609	9,031	0	12,578
2010-2011	21,609	9,031	0	12,578
2011-2012	21,609	9,031	0	12,578
2012-2013	21,609	9,031	0	12,578
2013-2014	21,609	9,031	0	12,578
2014-2015	21,609	9,031	0	12,578
2015-2016	21,609	9,031	0	12,578
2016-2017	21,609	9,031	0	12,578
TOTAL	**216,090**	**90,310**	**0**	**125,780**

Ex post emission reductions shall be based on the lowest value of the following:

(i) The amount of biogas fuelled or flared in the project activity during the crediting period that is monitored *ex post*;

(ii) *Ex post* calculated baseline, project and leakage emissions based on actual monitored data (monitoring of the parameters like volume of waste water flow, COD inlet and COD outlet to the system, along with other ex-ante fixed parameters) for the project activity.