



CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

- A. General description of project activity
- B. Application of a baseline and monitoring methodology
- C. Duration of the project activity / crediting period.
- D. Environmental impacts
- E. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the project activity.
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan

**SECTION A. General description of project activity****A.1 Title of the project activity:**

Siam Quality Starch Wastewater Treatment and Energy Generation Project in Chaiphum, Thailand
(the Project)

Version 1.4 03/01/2011

B.7.1 Data and parameters monitored:

Data / Parameter:	$F_{\text{digester}} / F_{\text{dig_out,m}}$
Data unit:	m ³ /hr
Description:	Flow rate of wastewater fed in to / discharge out of the digester
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	6,000
Description of measurement methods and procedures to be applied:	The flow rate is measured continuously using a flow meter. As the digester is kept in hydraulic balance, only one monitoring point is necessary.
QA/QC procedures to be applied:	The flow meter will be calibrated according to appropriate industry/international standards. The product of the measured flow rate and the measured COD load can be double checked against the factory's starch production records, with which there is a direct correlation.
Any comment:	Used for the calculations of $BE_{\text{lagoon,y}}$ and $PE_{\text{lagoon,y}}$

Data / Parameter:	OP_m
Data unit:	Day



Description:	Number of operation days in month																										
Source of data to be used:	SQS																										
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><th>Month</th><th>Operating Days</th></tr><tr><td>January</td><td>31</td></tr><tr><td>February</td><td>28</td></tr><tr><td>March</td><td>31</td></tr><tr><td>April</td><td>30</td></tr><tr><td>May</td><td>31</td></tr><tr><td>June</td><td>30</td></tr><tr><td>July</td><td>-</td></tr><tr><td>August</td><td>31</td></tr><tr><td>September</td><td>30</td></tr><tr><td>October</td><td>31</td></tr><tr><td>November</td><td>30</td></tr><tr><td>December</td><td>31</td></tr></table>	Month	Operating Days	January	31	February	28	March	31	April	30	May	31	June	30	July	-	August	31	September	30	October	31	November	30	December	31
Month	Operating Days																										
January	31																										
February	28																										
March	31																										
April	30																										
May	31																										
June	30																										
July	-																										
August	31																										
September	30																										
October	31																										
November	30																										
December	31																										
Description of measurement methods and procedures to be applied:	Based on biodigester operation																										
QA/QC procedures to be applied:	N/A																										
Any comment:	Used for the calculation of $BE_{lagoon,y}$																										

Data / Parameter:	$COD_{conc_in,baseline,m}$
Data unit:	$kgCOD/m^3$
Description:	COD concentration of effluent entering the lagoons in the baseline
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected	15



emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	This is equivalent to the COD concentration of raw effluent from the starch factory. The COD load will be measured either using standard COD tests either in house or through an outside laboratory, typically once a day.
QA/QC procedures to be applied:	Standard calibration will be carried out.
Any comment:	Used for the calculation of $BE_{lagoon,y}$

Data / Parameter:	T ₂																																											
Data unit:	°K																																											
Description:	Ambient temperature																																											
Source of data to be used:	SQS, directly measured																																											
Value of data applied for the purpose of calculating expected emission reductions in section B.5	<table><tr><th rowspan="2">Month</th><th colspan="2">Average Ambient Temperature</th></tr><tr><th>(°C)</th><th>(°K)</th></tr><tr><td>January</td><td>24</td><td>297.16</td></tr><tr><td>February</td><td>27</td><td>300.16</td></tr><tr><td>March</td><td>29</td><td>302.16</td></tr><tr><td>April</td><td>30</td><td>303.16</td></tr><tr><td>May</td><td>29</td><td>302.16</td></tr><tr><td>June</td><td>28</td><td>301.16</td></tr><tr><td>July</td><td>28</td><td>301.16</td></tr><tr><td>August</td><td>28</td><td>301.16</td></tr><tr><td>September</td><td>27</td><td>300.16</td></tr><tr><td>October</td><td>27</td><td>300.16</td></tr><tr><td>November</td><td>26</td><td>299.16</td></tr><tr><td>December</td><td>24</td><td>297.16</td></tr></table>			Month	Average Ambient Temperature		(°C)	(°K)	January	24	297.16	February	27	300.16	March	29	302.16	April	30	303.16	May	29	302.16	June	28	301.16	July	28	301.16	August	28	301.16	September	27	300.16	October	27	300.16	November	26	299.16	December	24	297.16
Month	Average Ambient Temperature																																											
	(°C)	(°K)																																										
January	24	297.16																																										
February	27	300.16																																										
March	29	302.16																																										
April	30	303.16																																										
May	29	302.16																																										
June	28	301.16																																										
July	28	301.16																																										
August	28	301.16																																										
September	27	300.16																																										
October	27	300.16																																										
November	26	299.16																																										
December	24	297.16																																										
Description of measurement methods and procedures to be	Daily average will be monitored, and translated to monthly average.																																											



applied:	
QA/QC procedures to be applied:	The results will be checked against local weather data from an official source.
Any comment:	Used for the calculation of $BE_{lagoon,y}$

Data / Parameter:	$D_{lagoon,project}$ (for every pond)
Data unit:	m
Description:	Depth of open lagoons
Source of data to be used:	SQS
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4.5m for all ponds
Description of measurement methods and procedures to be applied:	A marker will be put in place that will indicate the 5m depth, and daily checks will be conducted to show whether the depth is below or above this height.
QA/QC procedures to be applied:	N/A
Any comment:	Used for the calculation of $BE_{lagoon,y}$

Data / Parameter:	$Q_{sludge,m}$ / $Q_{sludge,y}$
Data unit:	m^3 / yr or t / yr
Description:	Amount of sludge generated and removed in month / year
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the purpose of estimating $BE_{lagoon,y}$, removal of 100% sludge at year end was assumed. In practice, sludge removal only occurs very infrequently. For estimating $PE_{sludge,y}$, a figure of 324 t/yr was used, based on extrapolation of operating parameters.
Description of measurement methods	The quantity of sludge will be either weighed or measured with a flow meter or V-notch weir and measurement of solids content.



and procedures to be applied:	
QA/QC procedures to be applied:	Weight scales and flow and density meters will be calibrated according to relevant industry/international standards.
Any comment:	Used for the calculation of $BE_{lagoon,y}$ and $PE_{sludge,y}$

Data / Parameter:	$COD_{conc_sludge,m}$
Data unit:	kgCOD/m ³
Description:	COD concentration of sludge removed in month
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A. In <i>ex ante</i> estimation it is assumed sludge is carried over until year end, when all sludge is removed.
Description of measurement methods and procedures to be applied:	The COD load will be measured either using standard COD tests either in house or through an outside laboratory. As sludge is removed infrequently, less than once a year, the COD test will be carried out not at any set interval, but as sludge removal occurs.
QA/QC procedures to be applied:	Standard calibration will be carried out.
Any comment:	Used for the calculation of $BE_{lagoon,y}$

Data / Parameter:	$Q_{fuel_oil,y}$
Data unit:	TJ
Description:	Quantity of fuel oil displaced in year y
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	140.6
Description of	The quantity of thermal energy displaced is equivalent to the energy content of



measurement methods and procedures to be applied:	the biogas fed into the burners for production of hot oil.
QA/QC procedures to be applied:	The meter will be calibrated according to appropriate industry/international standards.
Any comment:	Used for the calculation of $BE_{fuel_oil,y}$. As per AM0013, this value is to be capped at 140.6TJ which is the average of three years' historical consumption.

Data / Parameter:	$COD_{conc_dig_out,m}$
Data unit:	kgCOD/m ³
Description:	COD out of biodigester to lagoons
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3
Description of measurement methods and procedures to be applied:	The COD load will be measured using standard COD tests either in house or through an outside laboratory, typically once a day.
QA/QC procedures to be applied:	Standard calibration will be carried out.
Any comment:	Used for the calculation of $PE_{lagoon,y}$

Data / Parameter:	$Q_{biogas_total,y}$
Data unit:	m ³ /yr (wet or dry basis)
Description:	Quantity of biogas produced and collected in the digester in year y
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in	8,078,400



section B.5	
Description of measurement methods and procedures to be applied:	Flow meters are used to measure the quantity of biogas collected on a continuous basis, and data aggregated annually. When converting to/from wet/dry basis, the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” will be used.
QA/QC procedures to be applied:	The flow meters will be calibrated according to appropriate industry/international standards.
Any comment:	Used for the calculation of $PE_{phys_leak,y}$

Data / Parameter:	w_{CH_4}
Data unit:	m^3CH_4/m^3 biogas (wet or dry basis)
Description:	Fraction of methane in biogas
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.5
Description of measurement methods and procedures to be applied:	The methane content in biogas will be monitored using online measurements. When converting to/from wet/dry basis, the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” will be used.
QA/QC procedures to be applied:	The gas analyzer will be calibrated according to appropriate industry/international standards.
Any comment:	Used for the calculation of $PE_{phys_leak,y}$ and $PE_{stack,y}$

Data / Parameter:	$COD_{sludge,y}$
Data unit:	$kgCOD/m^3$ sludge or $kgCOD/t$ sludge
Description:	Chemical Oxygen Demand of the sludge used for land application
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected	0.10



emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	At least monthly, or as sludge removal occurs, if sludge removal occurs less frequently.
QA/QC procedures to be applied:	Standard calibration will be carried out.
Any comment:	For the calculation of $PE_{\text{sludge},y}$

Data / Parameter:	NC
Data unit:	kgN/kg sludge
Description:	Nitrogen content of sludge
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.10
Description of measurement methods and procedures to be applied:	At least monthly, or as sludge removal occurs, if sludge removal occurs less frequently.
QA/QC procedures to be applied:	Standard calibration will be carried out.
Any comment:	For the calculation of $PE_{\text{sludge},y}$

Data / Parameter:	$Q_{\text{elec_cons},y} / Q_{\text{fuel_cons},y}$
Data unit:	MWh / TJ
Description:	Quantity of electricity / fuel oil consumed due to the project activity in year y
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of	0



calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	<p>The consumption will be measured by a continuous electricity / flow meter, with data aggregated monthly.</p> <p>For electricity consumption, under normal circumstances this will be measured by a continuous meter. However, the following calculation will also be allowed in lieu of direct measurement where for any reason measurement is not carried out:</p> <p>Electricity consumption = [Total MW capacity of all affected equipment] x [number of days during which meter is not operational] x 24 hours / day x 1.1 where</p> <p>1.1 is to account for transmission loss; and</p> <p>[Total MW capacity of all affected equipment] is divided into the equipment for the biogas plant and equipment for the decanter system, as the Project will have two separate electricity meters. One of both sets of equipment can be included in the above calculation.</p>
QA/QC procedures to be applied:	<p>Upon enquiring with the Provincial Electricity Authority of Thailand, it was found that there are no set industry standards for either calibration method or frequency. In the absence of industry standards, the electricity meters will either be calibrated by the PEA or replaced, at a frequency recommended by the PEA.</p> <p>In case a PEA opinion cannot be obtained regarding the recommended frequency, the meters will be calibrated by the PEA or replaced, every 12 months.</p>
Any comment:	Used for the calculation of $PE_{energy_cons,y}$

Data / Parameter:	CO_2EF_{elec}
Data unit:	tCO ₂ /MWh
Description:	CO ₂ emission factor for electricity consumed at project site
Source of data to be used:	EGAT/EPPO/DEDE
Value of data applied for the purpose of calculating expected emission reductions in	N/A



section B.5	
Description of measurement methods and procedures to be applied:	Calculated as per AMS-I.D
QA/QC procedures to be applied:	N/A – data are obtained from official sources
Any comment:	Used for the calculation of $PE_{energy_cons,y}$

Data / Parameter:	$Q_{biogas_burner,y} / Q_{biogas_flare,y}$
Data unit:	m ³ biogas/h (wet or dry basis)
Description:	Volumetric flow rate of the biogas in wet or dry basis at normal conditions in the hour h
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A – for the purpose of <i>ex ante</i> estimation, $Q_{biogas_burner,y}$ and $Q_{biogas_flare,y}$ were used.
Description of measurement methods and procedures to be applied:	This parameter will be continuously measured by a flow meter. The same basis (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the biogas ($fv_{i,biogas,h}$) when the biogas temperature exceeds 60°C. Value to be averaged hourly or at a shorter time interval.
QA/QC procedures to be applied:	Flow meters are to be periodically calibrated according to the manufacturer's recommendation.
Any comment:	Used for the calculation of $PE_{stack,y}$

Data / Parameter:	T_{flare}
Data unit:	°C
Description:	Temperature of the exhaust gas of the flare
Source of data to be used:	SQS, directly measured
Value of data applied	N/A



for the purpose of calculating expected emission reductions in section B.6	
Description of measurement methods and procedures to be applied:	This parameter will be measured in the flare by a Type N thermocouple. A temperature above 500°C indicates that a significant amount of gases are still being burnt and that the flare is operating. If there is no record of the temperature of the exhaust gas of the flare or if the recorded temperature is less than 500 °C for any particular hour, it shall be assumed that during that hour the flare efficiency is zero.
QA/QC procedures to be applied:	Thermocouples should be replaced or calibrated every year.
Any comment:	Used for the calculation of $PE_{stack,y}$

Data / Parameter:	Flare operation parameter
Data unit:	min/h
Description:	Minutes that flare is detected during the hour h
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6	0
Description of measurement methods and procedures to be applied:	Measured continuously using a flame detector
QA/QC procedures to be applied:	
Any comment:	Used for the calculation of $PE_{stack,y}$

Data / Parameter:	T
Data unit:	°C
Description:	Temperature of the biogas



Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A – not estimated <i>ex ante</i> as density assumed to be $0.00065\text{tCH}_4/\text{m}^3\text{CH}_4$. However, temperature after blowers is 60 – 70°C.
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously/periodically by a meter. The measured data is used to determine the density of methane ρ_{CH_4} . No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing biogas volumes in normalized cubic meters.
QA/QC procedures to be applied:	Meter will be subject to a regular maintenance and calibrated in accordance with the national or international approved standards and procedures.
Any comment:	Used for the calculation of $\text{PE}_{\text{stack},y}$

Data / Parameter:	P
Data unit:	bar
Description:	Pressure of the biogas
Source of data to be used:	SQS, directly measured
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A – not estimated <i>ex ante</i> as density assumed to be $0.00065\text{tCH}_4/\text{m}^3\text{CH}_4$. However, pressure after blowers is approximately 450mb g.
Description of measurement methods and procedures to be applied:	This parameter will be measured continuously/periodically by a meter. The measured data is used to determine the density of methane ρ_{CH_4} . No separate monitoring of temperature is necessary when using flow meters that automatically measure temperature and pressure, expressing biogas volumes in normalized cubic meters.
QA/QC procedures to be applied:	Meter will be subject to a regular maintenance and calibrated in accordance with the national or international approved standards and procedures.
Any comment:	Used for the calculation of $\text{PE}_{\text{stack},y}$



Data / Parameter:	$Q_{\text{burner_stack},y}$
Data unit:	m^3/yr
Description:	Amount of burner stack gas in year y
Source of data to be used:	SQS, calculated based on monitored $Q_{\text{biogas_burner},y}$ and empirical factor
Value of data applied for the purpose of calculating expected emission reductions in section B.6	N/A – for the purpose of the <i>ex ante</i> estimation, $PE_{\text{stack},y}$ was approximated as a percentage of methane fed to the burner.
Description of measurement methods and procedures to be applied:	<p>This parameter will be obtained from the flow rate of the burner feed gas and a project-specific, empirically derived stack gas / Nm³ feed biogas factor obtained from an annual 20-hour measurement campaign.</p> <p>For conservativeness, two measures will be taken as follows:</p> <ol style="list-style-type: none">1. The highest Nm³ stack gas / Nm³ biogas ratio observed during the measurement campaign will be selected rather than the average ratio.2. The highest SBSTA conservativeness factor of 1.37 will be applied to the ratio selected as per 1 above. This is despite uncertainty range calculations conducted on the measurement campaign results and SBSTA both indicating that the appropriate conservativeness factor for the level of uncertainty associated with this type of measurement is 1.02.
QA/QC procedures to be applied:	Standard calibration will be carried out.
Any comment:	Used for the calculation of $PE_{\text{stack},y}$

Data / Parameter:	$w_{\text{CH}_4_stack}$
Data unit:	$\text{m}^3\text{CH}_4/\text{m}^3\text{stack gas}$
Description:	Fraction of methane in burner stack gas
Source of data to be used:	SQS or outside laboratory, directly measured
Value of data applied for the purpose of calculating expected	0.995



emission reductions in section B.6	
Description of measurement methods and procedures to be applied:	This parameter will be measured at least quarterly, in line with AM0013.
QA/QC procedures to be applied:	Meter will be subject to a regular maintenance and calibrated in accordance with the national or international approved standards and procedures. If outsourced, the outside entity should be ISO17025 accredited.
Any comment:	Used for the calculation of $PE_{stack,y}$

Data / Parameter:	Regulations and incentives relevant to wastewater
Data unit:	-
Description:	Thai regulations and/or incentives relevant to wastewater that may impact the baseline
Source of data to be used:	Thai official documents
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	Will be assessed at the renewal of the crediting period
QA/QC procedures to be applied:	N/A
Any comment:	N/A