
VERIFICATION REPORT AND CERTIFICATION STATEMENT

South Pole Carbon Asset Management Ltd.

**SD Biosupply Wastewater Treatment
and Biogas Utilization Project**

SGS Climate Change Programme

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Project Title:			
SD Biosupply Wastewater Treatment and Biogas Utilization Project			
Organisation:		Client:	
SGS United Kingdom Limited		South Pole Carbon Asset Management Ltd.	
Summary:			
SGS United Kingdom Ltd has performed the Voluntary Emission Reduction verification of the VCS project SD Biosupply Wastewater Treatment and Biogas Utilization Project. The verification includes confirming the implementation of the monitoring plan of the validated VCS PD (VCS project Ref. ID. 416) and the application of the monitoring methodology as per CDM Methodology AMS III.H, Version 12 valid from 11/06/2009 – 30/07/2009 and AMS I.C, Version 14 valid from 08/04/2009 – 30/07/2009. A site visit was conducted to verify the data submitted in the monitoring report. The proposed project activity involves installation of an anaerobic wastewater facility, based on Up-flow Anaerobic Sludge Blanket (UASB) technology, at the existing starch plant. The project will utilise the captured methane as fuel in biogas – heat generation devices to produce thermal which will be used in the starch production process, in case of any excess biogas it will be sent to flare. By installation of the biogas digester that will generate the biogas from wastewater coming out of the starch plant and methane destruction unit will result in reductions of the greenhouse gases (GHG) emission that are real, measurable and give long-term benefits to the mitigation of climate change. SGS confirms that the project is implemented in accordance with the validated VCS Project Description. The monitoring system is in place and the emission reductions are calculated without material misstatements. The Verification Report and other relevant information further meets all the requirements of the Voluntary Carbon Standard Verification Protocol contained in Sections 2.4 – 2.14 of the VCS. Our opinion relates to the projects GHG emissions and the resulting GHG emission reductions reported and related to the valid and registered project baseline and monitoring and its associated documents. Based on the information seen and evaluated we confirm that the implementation of the project has resulted in 39,137 tCO₂e during period 28/03/2006 up to 31/12/2008.			
Subject:		Indexing Terms	
VCS 2007.1 Verification			
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Abbreviations

AFOLU	Agricultural, Forestry and Other Land Use
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CH ₄	Methane
CL	Clarification Request
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
COD	Chemical Oxygen Demand
DEDE	Department of Alternative Energy Development and Efficiency
DNA	Designated National Authority
DOE	Designated Operational Entity
EB	Executive Board
EGAT	Electricity Generating Authority of Thailand
EPPO	Energy Policy and Planning Office, Ministry of Energy
ER	Emission Reduction
FAR	Forward Action Request
FM	Flow Meter
GHG	Greenhouse Gas(es)
GJ	Giga Joule
GM	Gas Meter
GWP	Global Warming Potential
HFO	Heavy Fuel Oil
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MR	Monitoring Report
MWh	Mega Watt Hour
MW	Mega Watt
M&V	Monitoring and Verification
NCV	Net Calorific Value
PP	Project Participant
QA	Quality Assurance
QC	Quality Control
SCADA	Supervisory Control and Data Acquisition
SGS	SGS United Kingdom Ltd
SSC	Small Scale
SSC WG	Small Scale Working Group
UASB	Upflow Anaerobic Sludge Blanket
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard
VCS PD	Voluntary Carbon Standard Project Description
VCUs	Voluntary Carbon Units

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1. Introduction

1.1 Objective

South Pole Carbon Asset Management Ltd. has commissioned an independent verification by SGS United Kingdom Limited of its reported greenhouse gas emission reductions from the “SD Biosupply Wastewater Treatment and Biogas Utilization Project” project as per VCS 2007.1 guidelines. The verifiers have reviewed the GHG data collected to date for the period between 28/03/2006 to 31/12/2008.

The purpose of this verification exercise is to independently review the objective evidence:

- Whether the project has resulted in emission reductions as declared by the organisation or GHG project's GHG assertion;
- The data reported is accurate, complete, consistent, transparent and free of material error or omission.

1.2 Scope and Criteria

This engagement covers verification of emission reductions from anthropogenic sources of greenhouse gases included within the project boundary of the SD Biosupply Wastewater Treatment and Biogas Utilization Project.

SGS' approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. SGS' examination includes assessment, on a test basis, of evidence relevant to the amounts and disclosures in relation to the project's GHG emission reductions for the defined reporting period.

1.3 VCS Project Description

The proposed project activity involves installation of an anaerobic wastewater facility, based on Up-flow Anaerobic Sludge Blanket (UASB) technology, at the existing starch plant. The project will utilise the captured methane as fuel in biogas – heat generation devices to produce thermal energy which will be used in the starch production process, if there is excess biogas it will be sent to flare.

By installation of the biogas digester that will generate the biogas from wastewater coming out of the starch plant and methane destruction unit will result in reductions of the greenhouse gases (GHG) emission that are real, measurable and give long-term benefits to the mitigation of climate change.

1.4 Level of Assurance

The parameters and values presented in the monitoring report were assessed through review of detailed project documentation and production records, interviews with personnel at SD Biosupply Co.,Ltd, Kalasin province, Thailand, checking of log books, collection of fuel analysis report, observation of established monitoring and reporting practices and assessment of the reliability of measuring equipment.

Information which was not available during site visit was reported as Clarification Request (CL), following submission of additional information, monitoring and operational records, and the reconsolidation of all reported data was assessed again.

1.5 Project Activity and Period Covered

This engagement covers emissions and emission reductions from anthropogenic sources of greenhouse gases included within the project boundary of the following project and period.

Title of Project Activity:	SD Biosupply Wastewater Treatment and Biogas Utilization Project
UNFCCC Registration Number (if applicable) :	Not applicable as this project not applied for CDM registration. VCS Project ID is 416
Monitoring Period Covered in this Report:	28/03/2006 – 31/12/2008
Project Participants:	1. SD Biosupply Co., Ltd. 2. South Pole Carbon Asset Management Ltd.
Location of the Project Activity:	99 Somdej-Khuchinarai, Kambong, Huai Phueng District, Kalasin, Thailand

2. Methodology

2.1 General Approach

SGS' approach to the verification is a two-stage process.

In the first stage, SGS completed a strategic review and risk assessment of the projects activities and processes in order to gain a full understanding of:

- Activities associated with all the sources contributing to the project emissions and emission reductions, including leakage if relevant;
- Protocols used to estimate or measure GHG emissions from these sources;
- Collection and handling of data;
- Controls on the collection and handling of data;
- Means of verifying reported data; and
- Compilation of the monitoring report.

At the end of this stage, SGS produced a Verification Checklist which, based on the risk assessment of the parameters, data collection and handling processes for each of those parameters, describes the verification approach and the sampling plan.

Using the Verification checklist, SGS verified the implementation of the monitoring plan and the data presented in the Monitoring Report for the period in question. This involved a site visit and a desk review of the monitoring report. This verification report describes the findings of this assessment.

2.2 Verification Team for this Assessment

Name	Role
Pitipoom Tungsirisuteekul	Lead Assessor
Nattarin Thunsiri	Assessor and Local Assessor
Kunal Sharma	Sectoral Scope Expert (scope 13)
Vikas Bankar	Sectoral Scope Expert (scope 1)

2.3 Means of Verification

2.3.1 Review of Project Documentation

The validated VCS PD^{/1/}, the monitoring report (version 1 dated 30/03/2008^{/22/}, the subsequent versions and version 11 dated 20/08/2010^{/24/} as the final version) submitted by the client and additional background documents related to the project performance were reviewed.

CAR #9 was raised due to the mismatches in the version of the VCS PD, used as reference documents at the time of verification, along with the cover page and section 1.1. The PP has corrected the version on the revised VCS PD to be consistent. This has been checked and found satisfactory, hence **CAR #9 was closed out**. However the final validated VCS PD has been used as a reference document to the project activity and monitoring methodology indicated in monitoring report.

A complete list of all documents reviewed is attached in section 8 of this report.

2.3.2 Onsite Inspections

As part of the verification, the following on-site inspections have been performed^{/28/}.

Location: 99 Somdej-Khuchinarai, Kambong, Huai Phueng District, Kalasin, Thailand	Date: 10/04/2008 and 12/03/2009
Coverage	Source of Information / Persons Interviewed
Review of performance records, interviews with project participants, collection of measurements, observations of established practices and testing of the accuracy of monitoring equipment for Monitoring Period: 28/03/2006 – 31/12/2008 The specific issues discussed during site visit are; - Management Approach to GHG commitment - Assessment of Project Boundary and discussions about the project activity and project technology. - Reliability and accuracy of readings considered for emission reduction calculations, Calibration procedure - Monitoring and measuring system - Collection of measurements - Observations of established practices - Data Verification of monitoring parameters - Consideration of monitoring period, monitoring methodology and emission reduction calculations - Quality Assurance – Management and operating system	<u>First visit (10/04/2008) :</u> Mr.Narong Tiyanich: Plant Manager of Somdej Flour Mill Co.,Ltd Mr. Mont Uthairattrakul: Deputy Managing Director of Papop Co.,Ltd, Technology Supplier & Operation Implementation Mr. Patrick Burgi: Managing Partner of Southpole Carbon Asset Management Ms. Jutamanee Martchamadol: CDM M&V Manager of Southpole Carbon Asset Management <u>Second visit (12/03/2009) :</u> Mr.Narong Tiyanich: Plant Manager of Somdej Flour Mill Co.,Ltd Mr. Suchai Rattananadhekul : Project Management Manager of PAPOP Co.,Ltd Ms. Kuntida Krisorncharoen : CDM Project Associate of Southpole Carbon Asset Management Mr. Sithisakdi Apichatthanapath: CDM Project Associate of Southpole Carbon Asset Management

2.3.3 Review of Monitoring Results and Verification of the Correct Application of Monitoring Methodology

This project was validated as a VCS project activity on 19/11/2009 (VCS project ID No 416, web link reference: <https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=416>). VCU's were claimed from 28/03/2006 to 31/12/2008. As per VCS 2007.1 requirement, VCU's can be registered back to the project start date provisions in VCS 2007.1 Clause 5.2.1. "For non-AFOLU projects, VCS 2007.1 validation shall be completed within two years of the Project Start Date, or shall be completed or contracted before 19 November 2008. In relation to validation contracts entered into before 19 November 2008, validation shall be completed by 19 November 2009 and proof of contracting prior to 19 November 2008 shall be provided". For this project the contractual relationship between the validator has been made on 12/03/2008 and project has been successfully validated within 19/11/2009^{/1/, /2/}.

And also in the last paragraph under clause 5.2.1 "The earliest Project Crediting Period Start Date under the VCS 2007.1 shall be 28 March 2006 for non-AFOLU projects and 1 January 2002 for AFOLU projects". in

this project the start date of crediting period is 28/03/2006 which was found inline to the requirement of VCS 2007.1. The commissioning letter from PAPOP^{/26/} was provided to substantiate the project start date in which the letter revealed that the project has been commissioned on 18/12/2005. This has been checked and found satisfactory.

CAR #8 was raised because the applied methodology (AMS.I.C version12) as mentioned in the first version of monitoring report was expired. The reason was the assignment to undertake the validation and verification was done in parallel. The first version of monitoring report was submitted when the validation has not been completed. In response to this CAR, the PP provided the revised monitoring report which applied the methodologies consistent with the VCS PD. In the validated VCS PD, methodology AMS III.H Version 12 and AMS I.C version 14 have been used. Also the same methodologies are adopted in the final monitoring report and its calculation sheet this has been verified and found consistent hence **CAR #8 was closed out**.

CL #6 was raised to obtain the calibration certificates of the below monitoring equipments covering the entire monitoring period. In response, the calibration certificates have been provided and verified. However, there are some gaps observed in the calibration periods (not covering the complete monitoring period) .

The PP clarified that the meters were changed and uninstalled in the period as mentioned below. The calibration certificates of these monitoring equipments have been provided also the with the plant equipment record of the meters changed as it was also observed, have also provided. All the supportive documents have been verified and found to be reliable.

Monitoring Equipment	Calibration Certificates	Gap of Calibration Certificates	Remark
Inlet wastewater meter to UASB (FM1) Serial Number : 6B00F220000	External calibration by Endress+Hauser ^{/9/} Date : 08/12/2004 Date : 25/03/2008 Date : 17/03/2009 Calibration frequency = 3 years	08/12/2007 – 24/03/2008 <u>Justification :</u> The maximum accuracy of the meter at 0.5% has been applied in the final ER calculation during the gap period in the conservative approach.	
Biogas flow meter sent to boilers (GM2) Serial Number : EJ-10209	External calibration by Endress+Hauser ^{/12/} Calibration date: 26/02/2005 & 24/06/2009 Calibration frequency = 3 years	27/02/2008 – 31/12/2008 <u>Justification :</u> The GM2 measures the biogas supplied to boiler by the gas storage and UASB. Since the biogas quantity measured by GM1 seems reasonable during the monitoring period and the meters.	The maximum accuracy of the meter at 0.6% has been applied in the MR however the baseline emission is calculated base on the COD removal approach which is more conservative. .

Biogas flow meter - Biogas produced (GM1) Serial Number : C9-9086 Installation since biogas plant start commissioning And Un-installation since 09/09/2008	External calibration by Endress+Hauser/ ^{10/} Calibration date: Date : 15/11/2004 Calibration frequency = 3 years	15/11/2007 – 08/09/2008	The maximum accuracy of the meter at 0.6% has been applied in the MR. However the baseline emission is calculated based on the COD removal approach which is more conservative.
Biogas flow meter - Biogas produced (GM1) Serial Number : 6571 Installation date : 09/09/2008	External calibration by FOX/ ^{11/} Calibration date: 05/09/2008 Calibration frequency = 3 years	No gap was found.	

According to the gap of calibration of the wastewater flow meter, the PP decided to adjust the reported figure by applying the maximum permissible error of the flow meter. The results of the delayed calibration showed that the error is smaller than the maximum permissible error. This was found consistent with the Guidelines for Assessing Compliance with the Calibration Frequency Requirements (EB52 Annex 60). The revised data has been verified and found satisfactory in a conservative manner as the result shown in lower emission reductions. However, there is no data adjustment for the gap calibration of the biogas flow meter (GM1 & GM2) because it is not affected on the final ER of project activity. The reason due to the emission reduction in the portion of wastewater treatment is comparing the result in two approaches between direct monitoring in biogas quantity and COD removal. From the comparison, the emission calculation from COD approach is more conservative. The clarification above was found reasonable and acceptable hence **CL #6 was closed out.**

As observed during site visit, there was insufficient information on cross-reference, data acquisition and processing systems thus **CL #11 was raised.** In response, the PP clarified that the routine cross-checking is done internally by the person in charge at the project plant. The ER calculation of the project activity was cross referenced by two different approaches which found conformity with the applied methodologies to assure the conservativeness. The data acquisition has been recorded and kept electronically. The plant records were also found to be well managed and properly handled for tracking the required data. These were found acceptable and satisfactory as the data acquisition and data processing systems are put in place, therefore **CL #11 was closed.**

2.3.4 Determinations of the Reductions in GHG Emissions

Parameter	Reported Value ¹	Verified Value
Volume of wastewater treated in the year y, $Q_{ww,y}$	m³	m³
28/03/2006 – 31/12/2006	228,430	227,288 (For Project Emission = 229,506)
01/01/2007 – 31/12/2007	298,533	295,408 (For Project Emission = 298,377)
01/01/2008 – 31/12/2008	266,396	258,509 (For Project Emission = 260,082)
Total	793,359	781,205
COD of wastewater entering the treatment plant, $COD_{ww, untreated,y}$	mg/L (Average)	mg/L (Average)
28/03/2006 – 31/12/2006	23,143	23,218
01/01/2007 – 31/12/2007	21,673	23,178
01/01/2008 – 31/12/2008	20,738	20,857
Total	21,782	21,665
COD of water exiting the UASB treatment process, $COD_{y, out, UASB}$	mg/L (Average)	mg/L (Average)
28/03/2006 – 31/12/2006	993	1,033
01/01/2007 – 31/12/2007	1,295	1,620
01/01/2008 – 31/12/2008	1,300	1,280
Total	1,210	1,289
Amount of biogas produced by the digester, $Biogas_{prod, y}$	Nm³	Nm³
28/03/2006 – 31/12/2006	4,356,141	2,739,134
01/01/2007 – 31/12/2007	4,529,843	4,529,572
01/01/2008 – 31/12/2008	4,165,660	4,182,894
Total	13,051,644	11,451,600
Amount of biogas flared in the year y, $BG_{TOFlare, y}$	Nm³	Nm³
28/03/2006 – 31/12/2006	781,315	781,092
01/01/2007 – 31/12/2007	980,442	989,033
01/01/2008 – 31/12/2008	327,375	480,036
Total	2,089,132	2,250,161
Amount of biogas sent to boiler in the year y, $BG_{combusted, y}$	Nm³	Nm³

¹ Reported value are the value reported in monitoring report version 3 (dated 19/02/2009) as the first version of MR is not covered the same monitoring period (28/03/2006 – 31/12/2008). Differential between reported value and verified value are subjected to the justification made to CARs/CLs raised.

28/03/2006 – 31/12/2006	1,958,820	1,958,907
01/01/2007 – 31/12/2007	3,753,990	3,620,676
01/01/2008 – 31/12/2008	3,837,285	3,852,238
Total	9,550,095	9,431,821
Quantity of fossil fuel co – fired or fired along with biogas during a year, y, Q_{FO, y}	Litres	Litres
28/03/2006 – 31/12/2006	874,560	874,560
01/01/2007 – 31/12/2007	526,810	526,810
01/01/2008 – 31/12/2008	261,810	273,300
Total	1,663,180	1,674,670
Quantity of starch produced, Q_{starch, y}	Kg	Kg
28/03/2006 – 31/12/2006	43,824,345	43,824,345
01/01/2007 – 31/12/2007	64,876,080	64,876,080
01/01/2008 – 31/12/2008	49,891,521	60,944,315
Total	158,591,946	169,644,740
Electricity consumption by wastewater (UASB) treatment plant in a year, y, EG_y	MWh	MWh
28/03/2006 – 31/12/2006	204.4	136.4
01/01/2007 – 31/12/2007	373.1	350.9
01/01/2008 – 31/12/2008	474.1	509.75 (incl. Jan'09)
Total	1,051.6	997.05

Regarding to the first version of monitoring report which was developed base on methodology AMS III.H version 8. The emission reduction of the project activity shall be calculated on the portion of ex-post monitoring of biogas recovered and combusted so **CAR #5 was raised** towards the justification why the same has not been reported in the monitoring report. In response, the PP revised the monitoring report and the ER calculation sheet to comply with the requirement of the methodology. Furthermore, the conservative approach for emission reduction calculation between 1) biogas recovered & combusted approach and 2) COD removal approach have been considered in the final emission reduction. The response provided by the PP was found satisfactory so **CAR #5 was closed out**. However the final validated VCS PD of this project, methodology AMS III.H version 12^{3/} and AMS I.C version 14^{4/} have been applied hence in the final monitoring report of this project is adopted the same methodologies to estimate emission reduction.

Based on the methodologies AMS III.H version 12 and AMS I.C version 14, verified value, calculate the emission reductions^{25/} as below.

$$BE_y = \{BE_{power, y} + BE_{ww, treatment, y} + BE_{s, treatment, y} + BE_{ww, discharge, y} + BE_{s, final, y}\} \quad (1)$$

$$BE_{power, y} = (BE_{elec, y} + BE_{y, FO}) \quad (2)$$

$$BE_{elec, y} = EG_y * EF_y \quad (3)$$

Since, there is no electricity generated from project activity, thus

$$BE_{elec, y} = 0$$

$$\begin{aligned}
 BE_{y, FO} &= Q_{FO, y} * NCV_{FO} * EF_{CO_2} & (4) \\
 &= (Q_{starch} * \text{specific fuel consumption}) * NCV_{FO} * EF_{CO_2} & (\text{Deviation 2}) \\
 &= (169,644,740 * 0.0338) \text{ Litre} * 0.93 \text{ Kg/liter} * 40.4 \text{ GJ/Tonne} * 77.4 \text{ tCO}_2/\text{TJ} * 10^{-6} \\
 &= 16,699 \text{ tCO}_2
 \end{aligned}$$

$$\begin{aligned}
 BE_{ww, treatment, y} &= \sum_i Q_{ww, i, y} * GWP_{CH_4} * B_{o, ww} * UF_{BL} * COD_{removed, i, y} * MCF_{ww, treatment, BL, i} & (5) \\
 &= 781,205 \text{ m}^3 * 21 \text{ tCO}_2/\text{tCH}_4 * 0.21 \text{ kgCH}_4/\text{kg COD} * 0.94 * (21,665 \text{ mg/L} * 87.62\% * 10^{-6}) * 0.8 \\
 &= 49,179 \text{ tCO}_2
 \end{aligned}$$

In baseline treated wastewater was not discharged into sea/lake/river, therefore methane emissions from degradable organic carbon in treated wastewater discharged, $BE_{ww, discharge, y}$ in the baseline situation is assumed to be zero.

The sludge is used for soil application in the baseline scenario. Therefore baseline methane emissions from anaerobic decay of the final sludge, $BE_{s, final, y}$ produced is also neglected.

From equation (1) and (4)

$$\begin{aligned}
 BE_y &= \{BE_{power, y} + BE_{ww, treatment, y} + BE_{s, treatment, y} + BE_{ww, discharge, y} + BE_{s, final, y}\} \\
 &= 16,699 \text{ tCO}_2 + 49,179 \text{ tCO}_2 \\
 &= 65,878 \text{ tCO}_2
 \end{aligned}$$

$$\begin{aligned}
 PE_{,y} &= \{PE_{power, y} + PE_{ww, treatment} + PE_{s, treatment} + PE_{ww, discharge, y} + PE_{s, final, y} \\
 &\quad + PE_{fugitive, y} + PE_{biomass, y} + PE_{flaring, y}\} & (6)
 \end{aligned}$$

$$\begin{aligned}
 PE_{Power, y} &= EG_y * EF_y & (7) \\
 &= 997.1 \text{ MWh} * 0.521 \text{ tCO}_2/\text{MWh} \\
 &= 520 \text{ tCO}_2
 \end{aligned}$$

$$\begin{aligned}
 PE_{ww, treatment, y} &= \sum Q_{ww, k, y} * COD_{removed, PJ, k, y} * MCF_{ww, treatment, PJ, k} * B_{o, ww} * UF_{PJ} * GWP_{CH_4} & (8) \\
 &= (1,011 * 87.62\%) \text{ Tonne} * 0.8 * 0.21 * 1.06 * 21 \text{ tCO}_2/\text{tCH}_4 \\
 &= 3,314 \text{ tCO}_2
 \end{aligned}$$

$$PE_{fugitive, y} = PE_{fugitive, ww, y} + PE_{fugitive, s, y} \quad (9)$$

$$\begin{aligned}
 PE_{fugitive, ww, y} &= (1 - CEF_{ww}) * MEP_{y, ww, treatment} * GWP_{CH_4} & (10) \\
 &= (1 - 0.9) * 2,834 * 21 \text{ tCO}_2/\text{tCH}_4 \\
 &= 5,951 \text{ tCO}_2
 \end{aligned}$$

$$\begin{aligned}
 MEP_{y, ww, treatment} &= Q_{y, ww} * B_{o, ww} * UF_{PJ} * \sum_k COD_{removed, PJ, k, y} * MCF_{ww, treatment, PJ, k} & (11) \\
 &= 783,034 \text{ m}^3 * 0.21 \text{ kgCH}_4/\text{kg COD} * 1.06 * 20,322 \text{ mg/L} * 0.8 * 10^{-6} \\
 &= 2,834
 \end{aligned}$$

$$FM_{RG, h} = \rho_{RG, n, h} * FV_{RG, h} \quad (12)$$

$$\begin{aligned}
 TM_{RG, h} &= FV_{RG, h} * fv_{CH_4, RG, h} * \rho_{CH_4, n} \\
 &= 2,250,160 * 71.44\% * 0.716 \\
 &= 1,150,980 & (13)
 \end{aligned}$$

$$\begin{aligned}
 PE_{\text{flare},} &= \sum_{h=1}^{8760} TM_{RG,h} * (1 - \eta_{\text{flare-h}}) * GWP_{CH_4} / 1000 \\
 &= 1,150,980 * (1 - 0.5) * 21 / 1000 \\
 &= 12,086 \text{ tCO}_2
 \end{aligned} \tag{14}$$

The project activity does not include sludge treatment system, therefore the emission from sludge treatment system, $PE_{s, \text{treatment}, y}$ are omitted.

$$PE_{s, \text{treatment}, y} = 0$$

In the project activity the treated wastewater will be discharge in existing open lagoons and there will be no discharge to river, sea or lake. This has been verified with the plant license^{5/} and observing during site visit. Hence, emissions from of inefficiency of the project activity wastewater treatment systems and presence of degradable organic carbon in treated wastewater, $PE_{\text{ww discharge } y}$ has not been included in the assessment.

$$PE_{\text{ww discharge } y} = 0$$

Due to the fact that a relatively small amount of final sludge is removed from the digester^{14/}, the project proponent applies final sludge for filed application as fertilizer and the final disposal of the sludge shall be monitored during the crediting period. Therefore as suggested by the AMS III.H, here the emission from anaerobic decay from the final sludge produced, $PE_{s, \text{final}, y}$ can be omitted.

$$PE_{s, \text{final}, y} = 0$$

Biomass storage is not envisaged in the project activity. Therefore methane emissions from biomass stored under anaerobic conditions, $PE_{\text{biomass}, y}$ which does not take place in the baseline situation are omitted.

$$PE_{\text{biomass}, y} = 0$$

Project emission as per methodology AMS I.C (portion of fuel oil used as auxiliary fuel in the project activity)

$$\begin{aligned}
 PE_{FC} &= Q_{FO, y} * NCV_{FO} * EF_{CO_2} \\
 &= 1,674,670 \text{ Litre} * 0.93 \text{ Kg/liter} * 40.4 \text{ GJ/Tonne} * 77.4 \text{ tCO}_2/\text{TJ} \\
 &= 4,870 \text{ tCO}_2
 \end{aligned} \tag{16}$$

From Equation (6) and (16)

$$\begin{aligned}
 PE_{,y} &= \{ PE_{\text{power}, y} + PE_{\text{ww, treatment}} + PE_{s, \text{treatment}} + PE_{\text{ww discharge}, y} + PE_{s, \text{final}, y} \\
 &\quad + PE_{\text{fugitive}, y} + PE_{\text{biomass}, y} + PE_{\text{flaring}, y} \} + PE_{FC} \\
 &= 520 \text{ tCO}_2 + 3,314 \text{ tCO}_2 + 5,951 \text{ tCO}_2 + 12,086 \text{ tCO}_2 + 4,870 \text{ tCO}_2 \\
 &= 26,741 \text{ tCO}_2
 \end{aligned}$$

$$\begin{aligned}
 ER_{y, \text{ex-ante}} &= BE_{y, \text{ex-ante}} - (PE_{y, \text{ex-ante}} + LE_{y, \text{ex-ante}}) \\
 &= 65,878 \text{ tCO}_2 - 26,741 \text{ tCO}_2 \\
 &= 39,137 \text{ tCO}_2
 \end{aligned} \tag{17}$$

The total emission reductions reported for the monitoring period of 28/03/2006 to 31/12/2008 was verified to be 39,137 tCO₂e.

2.3.5 Review of Additional Data from Other Sources if Appropriate

There are some parameters taken from validated VCS PD and the value has been validated but there were not reference to the methodologies, tools and IPCC mentioned in PD hence these values are again cross verified from the verified from the adopted the additional sources.

- **Density of fuel oil, D_{FO}** is obtained from publicly available information (http://www.engineeringtoolbox.com/fuels-densities-specific-volumes-d_166.html). The value applied for unit conversion is 0.93 Kg/liter.
- **Thailand National Grid emission factor, EF_y** It is unclear in the justification of the grid emission factor applied to calculate the emission from electricity consume in the project activity. **CL #12 was raised** to clarify why the grid emission factor used is fixed as 0.524 ton CO₂/MWh in monitoring period. The justification towards grid emission factor has been provided and found reliable. The **CL#12 was closed out**. This parameter is based on the calculation from the tool for the estimation of the emission factor of an electricity system. Fixed ex-ante is based on the tool for the estimation of the emission factor of an electricity system is chosen in a conservative manner. The data to calculate is gathering from EGAT, EPPO Official published data from Electricity Generating Authority of Thailand (EGAT) and Energy Policy and Planning Office (EPPO). This is found reliable. CO₂ emission factor for grid power was validated in the VCS PD. The value applied in the calculation of emission reductions is 0.524 tCO₂/MWh. However when the final VCS PD was validated, the grid emission factor mentioned as 0.521 tCO₂/MWh therefore **CL #25 was raised** asking for clarification to this adjustment. In response the PP clarified that the final grid emission factor has to be fixed with the final figure reported in the validated VCS PD^{/1/, /17/,/18/}. Also this figure is conservative when compared to the published grid emission factor from DEDE (Department of Alternative Energy Development and Efficiency). Clarification from the PP was found acceptable hence **CL #25 was closed** and grid emission factor at 0.521 tCO₂/MWh is used in the monitoring report.
- **NCV of methane is assumed to be equivalent to natural gas, $NCV_{natural\ gas}$** is taken from a default value from IPCC default value of $NCV_{methane}$ ^{/16/}. **CAR #4 was raised** for clarification towards the assumption of $NCV_{methane}$ is equivalent to $NCV_{natural\ gas}$. The justification towards the natural gas comprises of almost pure methane is provided with the publicly available reference (<http://www.naturalgas.org/overview/background.asp>) and found to be satisfactory. Thus the raised **CAR #4 was closed out**. The value was verified against a IPCC default value and monitoring report and ER spreadsheet and found correct. The value applied is 48 GJ/Tonne.

These parameters have been verified along with the validated VCS PD, monitoring report, emission reduction calculation sheet and supporting documents provided and were found consistent and acceptable.

2.4 Reporting of Findings

As an outcome of the verification process, the team can raise different types of findings

In general, where insufficient or inaccurate information is available and clarification or new information is required the team shall raise a Clarification Request (CL) specifying what additional information is required.

Where a non-conformance arises the team shall raise a Corrective Action Request (CAR). A CAR is issued, where:

- I. the verification is not able to obtain sufficient evidence for the reported emission reductions or part of the reported emission reductions. In this case these emission reductions shall not be verified and certified;
- II. the verification has identified misstatements in the reported emission reductions. Emission reductions with misstatements shall be discounted based on the verifiers ex-post determination of the achieved emission reductions

The verification process may be halted until this information has been made available to the assessors' satisfaction. Failure to address a CL may result in a CAR. Information or clarifications provided as a result of an CL may also lead to a CAR.

Observations may be raised which are for the benefit of future projects and future verification actors. These have no impact upon the completion of the verification activity.

Corrective Action Requests and New Information Requests are detailed in Verification Checklist. The Project Developer is given the opportunity to "close" outstanding CARs and respond to CLs and Observations.

2.5 Internal Quality Control

Following the completion of the assessment process and a recommendation by the Assessment Team, all documentation will be forwarded to a Technical Reviewer. The task of the Technical Reviewer is to check that all procedures have been followed and all conclusions are justified. The Technical Reviewer will either accept or reject the recommendation made by the assessment team.

3. Verification Findings

3.1 Remaining Issues, including any Material Discrepancy, FARs from Previous Validation

This is the first voluntary verification of the VCS validated project.

This project activity is a voluntary emission reduction activity which is not a registered CDM project under CDM registry. The project was validated with VCS (Voluntary Carbon Standard) programme in which this is first voluntary verification under VCS 2007.1 for period of 28/03/2006 – 31/12/2008. The VCS PD and related documents are available on VCS database <https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/EditProjectDoc.asp?id1=416>. There is one observation raised as a forward action request (FAR) to verify the operating days of starch plant in one year which cannot exceed 240 days. If not the re-assessing in the additionality of project activity is required. In the validated VCS PD^{1/} it mentioned that the ex-ante value of wastewater generated from starch plant is 2,000 m3 per day. Hence the limitation of this project activity is 480,000 m3 annually.

Period		Number of Months	Monitored Value	Limitation	Result
28/03/2006 31/12/2006	–	9	227,288	360,000	Passed
01/01/2007 31/12/2007	–	12	295,408	480,000	Passed
01/01/2008 31/12/2008	–	12	258,509	480,000	Passed

It is evident from the above discussion, the operating days of the project activity are never exceeding 240 days hence the implementation of project activity is inline to the validated project design in the current monitoring period. Thus the FAR (Observation raised during VCS Validation) has been closed out.

The monitoring period is 28/03/2006 – 31/12/2008 which the start date of this monitoring period corresponding with the earliest date for verification as per clause 5.2.1 of VCS 2007.1 requirement (i.e 28/03/2006) and coincides with the dates listed in the validated VCS PD section 7.

3.2 Project Implementation

The proposed project activity involves installation of an anaerobic wastewater treatment facility, Up Flow Anaerobic Sludge Blanket (UASB) biogas reactor technology, replacing the open anaerobic lagoon based system at the existing starch manufacturing plant. The biogas reactor system will generate and recover biogas for energy generation purposes, avoiding methane emissions to the atmosphere. The captured methane will be used as fuel in existing heat generating devices in the starch plant replacing heavy fuel oil, which will lead to further CO2 reductions by replacing a fossil fuel. Any surplus methane is flared in an open flare.

Project was implemented as described in the validated VCS PD. However there are some deviations made, as detailed below, from the monitoring plan as described in the validated VCS PD and applied methodologies.

As per VCS 2007.1 requirement clause 5.3,

“Methodology Deviations shall be project specific.

Methodology Deviations shall not be permitted where they result in changes to the conservativeness of the:

- baseline scenario;
- additionality determination;
- included project GHG sources, sinks and reservoirs.

Methodology Deviations shall be permitted where they do not impact negatively on the conservativeness of the VCS Program approved methodology's criteria and procedures to quantify data leading to GHG emission reductions or removals”.

There have been six deviations observed in this project activity during the monitoring period of 28/03/2006 – 31/12/2008. Description of the deviations also has been described in annexure-I of the monitoring report.

1. No monitoring equipment installed in the project activity to monitor the operational status of opened flare (as per methodology AMS III.H version 12 paragraph 37).

As the default value of combustion efficiency of opened flare system has been applied in emission calculation. The operation of flares needs to be monitored by the temperature sensor or flame detector as per the clarification from small scale working group (SSC WG) no.324 (weblink: <http://cdm.unfccc.int/methodologies/SSCmethodologies/clarifications/09757>). **CL #13 and CAR #21** were raised asking for clarification how to ensure that biogas sent to flare were combusted and inline with tool to determine project emissions from flaring gases containing methane. In response to CL #13, the PP provided the specification of opened flare^{25/} installed in the project activity which shown that the flaring system is equipped with automatically ignition and work when the biogas passes though the flare. The DOE was of the opinion that the flare system was in good and proper condition to consider the 50% flare efficiency. The clarification and supporting documents provided were found reasonable and consistent with the final emission reduction calculation sheet hence **CL #13 and CAR #21 were closed.**

2. Thermal energy generated from the project activity was not direct measurement on flow and temperature (as per methodology AMS I.C version 14 paragraph 29 (b)(i)) but taken result from the calculation method of specific heat consumption.

As the project activity has not been installed the measurement device for monitoring thermal energy generated hence **CL #23 was raised.** The PP provided the clarification to the deviation of methodology in the monitoring plan. The emission reduction claimed in this monitoring period is based on the 3 years historical data of the specific fuel consumption per dry starch production from the starch plant which has been applied. The annual average specific fuel consumption during year 2002 – 2004 are shown in below table,

Year	Dry Starch (Tonne)	Heavy Oil (litre)	Litre of HFO/kg of dry starch
2002	64,830	2,187,940	0.0338
2003	66,374	2,303,060	0.0345
2004	57,836	2,111,970	0.0375

The PP has considered the most conservative average specific energy consumption during 2002 -2004 (i.e 0.0338 lit of HFO/kg of dry Starch in year 2002) for calculations of emission reductions for the project activity as deviation from the applied methodology. Clarification from the PP found reasonable and in conservative approach hence **CL #23** was closed.

3. Fraction of methane in biogas has not been measured (as per methodology AMS III.H version12 paragraph 36)

As observed during site visit, it was found that there was no direct measurement of the methane content in the biogas, so **CAR #2 was raised.** In response, the PP provided the technical proposal from PAPOP (technology provider) which shows that 65% is a default value at the time of design phase. However, this value has been cross referenced with the publicly available information (<http://www.oregon.gov/ENERGY/RENEW/Biomass/biogass.shtml>) which indicated that the average methane content in biogas is in range between 55% - 80%. **CAR #22 was also raised,** for asking the justification on the impact of methane percentage on the baseline emission, project emission and how the conservativeness was maintained in final ER calculation. In response, the PP clarified that the emission reduction of methane destruction was divided in two portions. Baseline emission was calculated based on the COD removal approach hence the methane content has not affected the emission calculation. In the project emission, methane content was a direct parameter to estimate the emission. The higher value of methane content would be more conservative to determine the project emission.

As there was no actual monitored figure of methane content in the monitoring period (28/03/2006 – 31/12/2008), the average value of methane content during 20/01/2010 – 28/02/2010 with the maximum 95% confidence level was adopted to calculate project emissions in the absence of monitoring methane content.

The final ER calculation was the most conservative when applying the methane content as 71.4 % which is higher than the design specification (65%) and considering that the higher value of methane content is not justified for the project activity as not implemented under ideal conditions.

Clarification from the PP was found reasonable and acceptable hence **CAR #2 and CAR #22 were closed.**

4. As observed during site visit, there was no meter installed in the project activity to quantify the biogas quantity sent to flaring system which is deviated from the validated monitoring plan and the applied methodology (as per methodology AMS III.H version 12 paragraph 36). Due to the reason above, **CAR #1 was raised**. The PP has referred to the reference to the latest version of methodology applied in this project (i.e AMS III.H version 14) and the clarification from CDM small scale working group (SSC WG) No.376 (weblink ; <http://cdm.unfccc.int/methodologies/SSCmethodologies/clarifications/86108>) that allows the determination of the biogas captured from the two separately monitored fractions (biogas utilized and flared). Since the clarification were approved by the SSC WG, the determination of the biogas quantity sent to flare from the differential quantity of biogas recovered and utilized in boiler was found reasonable and appropriate to the project activity. So, **CAR #1 was closed out.**

5. The quantity of the final sludge and end-use application has not been monitored during the monitoring period (as per methodology AMS III.H version 12 paragraph 39). Due to this reason **CAR #3 and CL #24 were raised** for clarification in the monitoring procedure of final sludge generated from the project activity which is required by the methodology. In response, the PP clarified that the final sludge generated from the project activity was handled by the technology provider which would be used as the start up feeding for the other anaerobic digester. However, final sludge was used as fertilizer and land application so it could be neglected. The technology supplier also substantiated the plant record of sludge removed in year 2007. Furthermore, the quantity of sludge generated in this project was calculated based on the concentration of COD removed in the project activity as per design specification of the digester. The calculated value has also been used for cross reference with the sludge removal as shown in the plant record. This has been verified and found reasonable. The assessment team has also conducted the interviewing with the technology provider during site visit to confirm the same. Due to explanation above, **CAR #3 and CL #24 were closed.**

6. Quantity of fossil fuel fired along with biogas in the boiler has not been monitored as per the monitoring plan mentioned in the validated VCS PD.

There was no continuous flow meter to quantify the fuel oil consumption in the boiler during the claim monitoring period which was before the validation of this project activity. The PP decided to use the data obtained from the invoices of heavy fuel oil in the absence of data reading from the meter. The invoices have been provided and checked. The reported data were reliable and found consistent with the invoices as supporting evidences.

As per deviations above described (1 – 6), these were found acceptable as there was no negative impact on the conservativeness of emission reduction calculation and the additionality of the project. Furthermore, these deviations are subjected to forward action request as the **FAR #26 was raised** to install the monitoring equipment as per the monitoring methodology mentioned in the validated VCS PD.

3.3 Completeness of Monitoring

Monitoring of reductions in GHG emissions to result from the validated project have been implemented in accordance with the monitoring plan contained in the VCS PD however there are some deviation observed which described under section 3.2 above. Furthermore, the monitoring mechanism is effective and reliable which can finalise the final figure as ER calculation.

The monitoring parameters are listed as below.

Volume of wastewater treated in the year y, $Q_{ww,y}$ is measured by direct measurement with flow meter (FM1) to quantify flow of waste water entering to the USAB tank as continuously. The data is collected automatically continuous record by SCADA and manually record on hourly basis for the data cross checking. The shift operator reports the data to plant manager for review and approval. The staff is trained according to the plant manual namely Manual of biogas generation, SD Biosupply Co., Ltd. During the site visit, the members of staff were interviewed and showed good understanding and competency regarding the importance of data monitoring. There is a defined project manager with relevant qualification and experience supported by adequately trained and experienced staff. Manual records recorded in the check sheet is used as cross reference.

CL #6 was raised to provide calibration certificate of meter FM1 is not available for the period starting from 08/12/2007 – 24/03/2008. The raised **CL #6 was closed** out due to the uncertainty level of measurement at 0.5% has been taken into account for the gap period of 08/12/2007 – 24/03/2008 for conservative manner.

CAR #7 and CAR #19 were raised in regarding to the data mismatch of wastewater flow was found when verified the data record in log sheet against the emission reduction calculation spreadsheet. In the response, the PP explained that the mismatch was due to human error and the emission reduction spreadsheet has been corrected with the original data source in the log sheet. The revised spreadsheet has been verified and found that the correction is consistent with the original plant log sheet. The raised **CAR #7 and CAR #19 were closed out**.

COD of wastewater entering the treatment plant, $COD_{ww, untreated,y}$ is measured by Colorimetric analysis^{/13/}. The wastewater sampled to analyze is at entering the treatment facility. Test results are recorded in a daily timesheet on a daily basis and then delivered to the biogas plant supervisor for data review and submission to the assistant plant manager for approval. The measurement data was verified with the plant historical records and data reported in the ER spreadsheet and found correct.

CAR #7 and CAR #18 were raised regarding to the data mismatch of COD (influent) concentration which was found when verifying the data record in the log sheet against the emission reduction calculation spreadsheet. In response, the PP corrected the emission reduction spreadsheet with the raw data in the log sheet. The revised spreadsheet has been verified and found to be correct. Therefore, the raised **CAR #7 and CAR #18 were closed out**.

COD of water exiting the UASB treatment process, $COD_{y, out, UASB}$ is measured by Colorimetric analysis. The wastewater is sampled for analysis upon exiting the UASB treatment process. The colorimeter used is the same meter used for analyzing the COD of water entering the UASB treatment. Test results is recorded in a daily timesheet on a daily basis and then delivered to biogas plant supervisor for data review and submission to the assistant plant manager for approval. The measurement data was verified with the plant historical record and data reported in the ER spreadsheet and found correct.

CL #6 was raised to obtain the calibration certificates of colorimeter covering the monitoring period. Regarding the gap of calibration certificate of COD colorimeter on the period of 28/03/2006 – 05/05/2008, the absorbance reading zero from DI water for blank samples are done daily prior COD measurement. Moreover, the COD measurement is always done by using new standard chemical for daily COD measurement by time to time. In addition, the calibration certificate on 06/05/2008^{/13/} shown that the data reading is still in the acceptance range. Thus, **CL06 was closed out**.

In the monitoring worksheet, some value of COD effluent has been reported as zero in the day which there was no direct measurement. So **CAR #16 was raised** towards justification of the conservativeness in this approach. In response, the PP decided to adjust the report data for COD effluent as summarize in the below table.

Monitoring Year	Data Adjusted in the absence of no $COD_{y, out, UASB}$ reported (mg/l)	Justification towards the acceptance
2006	2,664	Maximum COD out observed during year 2007 is applied as a conservative manner. The value is also compared with the value in the validated VCS PD (2,297 mg/l) and 90% removal efficiency of design digester specification (2,318 mg/l). Thus, the adjust value is found higher and results in lower emission

		reduction.
2007	3,300	Maximum COD out observed during year 2008 is applied as a conservative manner. The value is also cross reference with the value in the validated VCS PD (2,297 mg/l) and 90% removal efficiency of design digester specification (2,322 mg/l). Thus, the adjust value is found higher and results in lower emission reduction.
2008	$COD_{y, out, UASB} = COD_{ww, untreated, y}$	This assumption leads to zero COD removal and results in no emission reduction for the data adjusted.

The revised MR and MR calculation sheet has also been provided. The assessment team has verified the data adjusted in the spreadsheet and it is accepted. The justification provided by the PP is found reliable and results in lower emission reduction in a conservative manner. Due to the reason provided, **CAR #16 was closed out.**

Amount of biogas produced by the digester, Biogas_{prod, y} is a direct measurement by metering (GM1). The meter is read in accumulated value and reported value in the unit of Nm³. This flow meter is integrated with Supervisory Control And Data Acquisition system (SCADA). The biogas plant supervisor is responsible to review the data calculating and data reported in the ER spreadsheet and monitoring report. The meter measures the volume of biogas as the design & calibration range of flow meter. The measurement uncertainty is +/- 0.6% of reading. **CL #6 was raised** to obtain the calibration certificates of biogas meter to measure the volume of biogas recovered from the digester during the monitoring period. In response, the PP provided the calibration certificates including the justification towards gap of calibration certificates which not covering the claimed period (see details in section 2.3.3 of this report). The maximum permissible error of the meter was applied to adjust the biogas recovered quantity during the gap of calibration. Regarding to the baseline emission, the PP explained that the BE_{y, ex post} (COD approach) would be more conservative than MD_y approach. Therefore, the data adjustment for the gap of delay calibration period has no negative impact on the conservation of baseline emission which lead to higher emission reduction. On the other hand, the adjustment of the delay calibration results in the higher project emission which lead to the lower emission reduction. This justification was found satisfactory and in a conservative manner. Therefore, the raised **CL #6 was closed out.**

CAR #7 and CAR #19 were raised as a data mismatch of biogas flow of data reading for Biogas sent to boiler was found. The monitoring spreadsheet and monitoring report has been modified with the correct data and found satisfactory. Hence, the raised **CAR #7 and CAR #19 were also closed out.** However **CAR #17 was raised** asking for correction as the reported value of GM1 and GM2 in March 2008 are incorrect. The PP revised the calculation worksheet to be consistent with supporting documents so **CAR #17 was closed.**

The training programme related to the project activity and implementation was provided to relevant staffs by Papop Company. The staff was trained according to the plant manual namely Manual of biogas generation, SD Biosupply Co., Ltd. There is defined project manager with relevant qualification and experience supported by adequately trained and experienced staff. The data reported in the ER spreadsheet was verified against the plant record and found to be correct. There is the process of internal review before sending the data for emission reduction calculation.

Amount of biogas sent to boiler in the year y, BG_{combusted, y} is direct measurement by metering (GM2). Similarly to the parameter of amount of biogas recovered in the year y, the meter is read in accumulate value and reported in the unit of Nm³. This flow meter is integrated with Supervisory Control And Data Acquisition system (SCADA). The biogas plant supervisor is responsible to review the data calculating and data reported in ER spreadsheet and monitoring report. **CL #6 was also raised** to obtain the calibration certificates of gas meter to measure the volume of biogas sent to boiler covering the monitoring period. The PP has clarified the gap period of calibration certificate which not covering the claimed period was due to meter changed and replaced in that period. The calibration certificates have been obtained (see details in section 2.3.3 of this report). This was verified against calibration certificates provided and record of the meters changes and found reliable. Due to the gap of delay calibration, the maximum permissible error of the meter was applied to adjust the quantity of biogas utilized during the gap of calibration. Similarly to the explanation in the above deviation, the PP explained that the BE_{y, ex post} (COD

approach) would be more conservative than MD_y approach. Thus, the data adjustment for the gap of delay calibration period has no negative impact on the conservation of baseline emission which leads to higher emission reduction. On the other hand, the adjustment of the delay calibration results in the higher project emission and leads to the lower emission reduction. Due to the explanation above, the raised **CL #6 were closed out. CAR #7 and CAR #19 were raised** as the data mismatch of biogas flow of data reading for Biogas sent to boiler was found. The monitoring spreadsheet and monitoring report has been modified with the correct data and found satisfactory. Hence, the raised **CAR #7 and CAR #19 were also closed out.**

In addition, **CAR #10 was raised** asking for clarification why the quantity of biogas sent to boiler can be much higher than biogas generated from the digester. In response, the PP clarified that the biogas flow meter for total biogas generated is measured at the digester but the flow meter of biogas sent to boiler is installed at the point after the storage balloon. The difference in daily biogas generated can occur by the biogas storage however when considering in a monthly or a yearly period the biogas sent to boiler is still less than the total biogas generated. Clarification from the PP was found to be reasonable hence **CAR #10 was closed out.**

Amount of biogas flared in the year y, BG_{TOFlare, y} is taken from calculation. There is no installed meter to quantify the amount of biogas sent to flare. This is also a deviation from the applied methodology and as described in the VCS PD. **CAR #1 was raised** as the method to quantify amount of biogas flared was not inline with the applied methodology AMS.IIIH version 12. The clarification has been obtained and found that there was a gas meter to quantify biogas sent to boiler and recovered but no gas meter to quantify biogas sent to flare. So, the data was calculated from the assumption that the total biogas generated is equal to the total biogas utilized (total produced biogas - biogas sent to boiler = biogas sent to flare). The calibration certificates of the gas flow meters (biogas sent to boiler & captured biogas) were provided and found satisfactory. The deviation to the methodology was explained as Annex1 of MR and found that the deviation was in the conservative manner and has no impact in increasing in emission reduction. Thus, the raised **CAR #1 was closed out.**

The training programme related to the project activity and implementation is provided to relevant staff members by PAPOP Company. The staff is trained according to the plant manual namely Manual of biogas generation, SD Biosupply Co., Ltd. There is defined project manager with relevant qualification and experience supported by adequately trained and experienced staff. The data reported in the ER spreadsheet was verified against the plant record and found to be correct. There was the process of internal review before sending the data for emission reduction calculation.

Quantity of fossil fuel co – fired or fired along with biogas during a year, y, Q_{FO, y} is taken from invoices of fossil fuel. The data is recorded in the unit of Litres. The source of data is inconsistent as per described in the validated VCS PD in which the continuous flow meter will be used to quantify the fossil fuel consumption in the boiler directly. In practice, the data has not been monitored by metering but obtained from the invoices issued by the supplier. The data is reported in both MR and MR spreadsheet. However **CAR #14 was raised**, asking for supporting documents to substantiate the figure reported for the fossil fuel fired in the project activity. In response, the PP provided the summary data for fuel oil consumption in year 2006 – 2008 which signed and approved by the starch plant. Also **CAR #20 was raised** as there are data mismatches reported in the calculation workbook. The PP revised the monitoring workbook along with supportive document has been verified and found satisfactory hence **CAR #14 and CAR #20 were closed.** The biogas plant supervisor is responsible to review the data calculating and data reported in the ER spreadsheet and monitoring report. There is the process of internal audit before sending the data for emission reduction calculation. **CL #11 was raised** to substantiate on the QA/QC procedure and cross reference. The clarification is provided as QA/QC is done via multiple approaches by the internal cross checking for data relationships with database, cross referenced as reported in the validated VCS PD and the data will be recorded electronically and the monitoring records also kept with proper data management system. So, the raised **CL #11 was closed out.** The measurement data is cross checked with the plant historical record and data reported in the ER spreadsheet and found correct. The quantity of fossil fuel consumption is cross checked against the fuel oil quantities purchased and stock records. The data reported in ER spreadsheet is verified against the invoices and found correct.

Quantity of starch produced, Q_{starch, y} is gathering from starch plant record. Data is reported in tonne of starch produced. The biogas plant supervisor is responsible to review the data calculating and data reported in ER

spreadsheet and monitoring report. The starch production was verified against the starch plant record. However **CAR #14 was raised**, asking for supporting documents to substantiate the figure reported for the starch production in the project activity. In response, the PP provided the summary data for starch production in year 2006 – 2008 which signed and approved by the starch plant. This document has been verified and found satisfactorily hence **CAR #14 was closed**. The data reported in ER spreadsheet is verified against the invoices and found correct. There is the process of internal audit before sending the data for emission reduction calculation.

Electricity consumption by wastewater (UASB) treatment plant in a year, y, EC_y The electricity consumption in the wastewater treatment plant system is monitored continuously using the electricity meter (PEA meter). The meter readings are monitored and recorded by the PEA. The reported data were summarized from the monthly electricity invoices issued by the PEA. In particular, there was no data record for the electricity consumption on a daily basis. Thus, the PP decided to use the electricity consumption for a whole month (January 2009) to calculate the project emission due to the electricity consumption during 29/12/2008 – 31/12/2008 which not covered in the invoice of December 2008. This was found to be reliable and a conservative approach. Besides, **CAR #3 was raised** as there was no monitoring data reported for electricity consumption for the treatment process. **CAR #3 was closed out** due to the electricity invoices^{15/} being provided as documentary proof of the electricity consumption for the project activity. However **CAR #20 was raised** as there is the data mismatch observed in the monitoring worksheet. The PP response with the revised monitoring worksheet which was verified and found to be in consistency with the information reported so **CAR #20 was closed out**. The data is recorded in the unit of MWh. This is consistent as described in the VCS PD and reported in the ER spreadsheet. The biogas plant supervisor is responsible to review the data calculating and data reported in ER spreadsheet and monitoring report. The electricity onsite consumption is cross checked against the electricity bill and cross reference against meter readings. The data reported in ER spreadsheet is verified against the invoices and found correct.

The amount of sludge treated in the sludge treatment system, S_{I, PJ, y}, Sludge removed and its application are not being monitored whereas these are mentioned in the PD and should be monitored as per the requirement of applicable methodology, thus **CAR #3 was raised**. The PP has clarified that the final sludge disposal is monitored and recorded by PAPOP Company, who is the technology supplier and consultant. The sludge transfer record from UASB for start-up the other plant was provided by PAPOP Company. This was verified and found in accordance of the applied methodology. Hence, the raised **CAR #3 was closed out**.

In addition, **CAR #9 was raised** as under section 4 of the monitoring report has mentioned the monitoring period as March 28, 2006 – October 31, 2008 which the period is inconsistent with other sections of the monitoring report and the emission reduction calculation sheet. In the response, the monitoring report has been revised with the correct period as March 28, 2006 to December 31, 2008 to maintain consistency in documentation. Therefore the raised **CAR #9 was closed out**.

CAR #19 was raised due to a data mismatch was found when verifying the plant log book with the monitoring spreadsheet in the whole month of May 2008. The PP has submitted the revised spreadsheet which the data mismatch has been corrected. So, the raised **CAR19 was closed out**.

3.4 Accuracy of Emission Reduction Calculations

The calculation of emission reductions is found to be correct. No CARs/CLs were raised. The details of the reported and the verified values for all parameters are listed above in section 2.3.4. The comparison of emission reduction between the estimated in the validated VCS PD and the actual monitoring is shown in below table.

Sources	Number of Months	Period	Actual Emission Reduction	Average ER/Month	Comparison in the same period (33 months)
Estimated in validated VCS PD	12	One year	18,432	1,536.00	50,688
Actual Monitoring	33	28/03/2006 -	39,137	1,185.97	39,137

		31/12/2008			
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The major factors that affected the emission reduction during monitoring period compared to the ex-ante estimation in the validated VCS PD is;

- There is fossil fuel consumption to be used as auxiliary fuel in the boiler which account as the project emission to the final emission reduction.
- And the conservative approach applied for the deviation in the project activity as described under section 3.2 of this verification report.

The above clarification towards the factors affected the emission reduction is found reasonable and consistent with the actual activity observed during site visit hence no further information were raised for clarification.

3.5 Quality of Evidence to Determine Emission Reductions

Critical parameters used for the determination of the Emission Reductions are discussed above in section 2.3.3. All the data recorded are in compliance with the monitoring report^{24/}.

3.6 Management and Operational System and Quality Assurance

In order to verify data quality, the Companies involved in the project work in accordance with the instructions of project operation, which establishes the operational and management structure implemented. The allocation of responsibilities for the project implementation is as per organization structure. The Job Description and role of responsibility is clearly defined. The GHG management process is under supervision of Biogas System Manager and Plant Manager who in charge for data reviewer and approval.

The companies involved in the project have established quality assurance system implemented. The project manual with the instructions of project operation, QA/QC and management system is robust. The plant manual is provided by PAPOP Company who is the technology supplier and distributed to staff who are involve in the project activity. The project implementation is done under supervision of Assistant Plant Manager and Biogas Plant Manager. The plant is operated by two trained operators per shift who collect data under the supervision of the biogas plant supervisor. The biogas plant supervisor is responsible for summarizing, filing and processing data and he will report to the assistant plant manager for data approval.

However there was some contradicting information which was observed during the site visit and the information indicated in the VCS PD. Hence **CAR #15 was raised**. In response, the PP clarified that the information in VCS PD shall be revised to be consistent with actual operations on site. The revised VCS PD and final validated VCS PD has been checked in which it was found that the monitoring procedure has been correctly reported as observed during the site visit. Due to the reason above, **CAR #15 was closed**.

The reported data is cross checked with its raw data to ensure data quality and correctness. The risk involved in the project activity is identified and reporting to Biogas Plant Manager for preventive and corrective measures to be taken. Therefore we can affirm that the management system the VCS project is in place; with the responsibilities properly identified and in place.

4. Calculation of Emission Reductions

Parameter	Reported Value ²	Verified Value
Volume of wastewater treated in the year y, $Q_{ww,y}$	m³	m³
28/03/2006 – 31/12/2006	228,430	227,288 (For Project Emission = 229,506=)
01/01/2007 – 31/12/2007	298,533	295,408 (For Project Emission = 298,377)
01/01/2008 – 31/12/2008	266,396	258,509 (For Project Emission = 260,082)
Total	793,359	781,205
COD of wastewater entering the treatment plant, $COD_{ww, untreated, y}$	mg/L (Average)	mg/L (Average)
28/03/2006 – 31/12/2006	23,143	23,218
01/01/2007 – 31/12/2007	21,673	23,178
01/01/2008 – 31/12/2008	20,738	20,857
Total	21,782	21,665
COD of water exiting the UASB treatment process, $COD_{y, out, UASB}$	mg/L (Average)	mg/L (Average)
28/03/2006 – 31/12/2006	993	1,033
01/01/2007 – 31/12/2007	1,295	1,620
01/01/2008 – 31/12/2008	1,300	1,280
Total	1,210	1,289
Amount of biogas produced by the digester, $Biogas_{prod, y}$	Nm³	Nm³
28/03/2006 – 31/12/2006	4,356,141	2,739,134
01/01/2007 – 31/12/2007	4,529,843	4,529,572
01/01/2008 – 31/12/2008	4,165,660	4,182,894
Total	13,051,644	11,451,600
Amount of biogas flared in the year y, $BG_{TOFlare, y}$	Nm³	Nm³
28/03/2006 – 31/12/2006	781,315	781,092
01/01/2007 – 31/12/2007	980,442	989,033
01/01/2008 – 31/12/2008	327,375	480,036
Total	2,089,132	2,250,161
Amount of biogas sent to boiler in the year y, $BG_{combusted, y}$	Nm³	Nm³
28/03/2006 – 31/12/2006	1,958,820	1,958,907

² Reported value are the value reported in monitoring report version 3 (dated 19/02/2009) as the first version of MR is not covered the same monitoring period (28/03/2006 – 31/12/2008).

01/01/2007 – 31/12/2007	3,753,990	3,620,676
01/01/2008 – 31/12/2008	3,837,285	3,852,238
Total	9,550,095	9,431,821
Quantity of fossil fuel co – fired or fired along with biogas during a year, y, Q_{FO, y}	Litres	Litres
28/03/2006 – 31/12/2006	874,560	874,560
01/01/2007 – 31/12/2007	526,810	526,810
01/01/2008 – 31/12/2008	261,810	273,300
Total	1,663,180	1,674,670
Quantity of starch produced, Q_{starch, y}	Kg	Kg
28/03/2006 – 31/12/2006	43,824,345	43,824,345
01/01/2007 – 31/12/2007	64,876,080	64,876,080
01/01/2008 – 31/12/2008	49,891,521	60,944,315
Total	158,591,946	169,644,740
Electricity consumption by wastewater (UASB) treatment plant in a year, y, EG_y	MWh	MWh
28/03/2006 – 31/12/2006	204.4	136.4
01/01/2007 – 31/12/2007	373.1	350.9
01/01/2008 – 31/12/2008	474.1	509.75 (incl. Jan'09)
Total	1,051.6	997.05

Emission reduction calculation already described under section 2.4 above, the below table is showing the annual emission reduction of project activity during 28/03/2006 to 31/12/2008.

Monitoring Period	Baseline Emission (tCO ₂ e)	Project Emission (tCO ₂ e)	Emission Reduction (tCO ₂ e)
28/03/2006 – 31/12/2006	19,599	9,462	10,137
01/01/2007 – 31/12/2007	25,038	10,730	14,308
01/01/2008 – 31/12/2008	21,241	6,549	14,692
Total	65,878	26,741	39,137

5. Recommendations for Changes in the Monitoring Plan

No recommendation has been given to the PP regarding the change in the monitoring plan mentioned in the validated VCS PD. However, there are some monitoring equipments which have not been installed and implemented to project activity which lead to the deviation in monitoring plan of project activity.

The following parameters and monitoring procedure shall be followed the monitoring plan mentioned in the validated PD,

1. Flame detector and/or temperature sensor to determine the operation of the opened flaring system as per methodology AMS III.H version 12 paragraph 37 and Tool to determine project emissions from flaring gases containing methane (EB28 Annex13) step 6.
2. The monitoring equipment to quantify the thermal energy generated in the project activity as mentioned;
 - Direct measurement of flow and temperature is required as per methodology AMS I.C version 14 paragraph 29 (b) (i). "...In the case of heat energy (e.g. hot air, hot water), direct measurement of flow and temperature is required..."
3. Methane content in the biogas shall be monitored and record as per methodology AMS III.H version 12 paragraph 36 "...The fraction of methane in the gas should be measured with a continuous analyser or, alternatively, with periodical measurements at a 95% confidence level...."
4. Amount of biogas utilized and flared shall be monitored as per methodology AMS III.H version 12 paragraph 36 and clarification from CDM small scale working group (SSC WG) No. 376 ; "...In all cases, the amount of biogas recovered, fuelled, flared or utilized (e.g., injected into a natural gas distribution grid or distributed via a dedicated piped network) shall be monitored *ex post*, using continuous flow meters....".
5. The record of sludge quantity and its application shall be direct monitoring and record as per methodology AMS III.H version 12 paragraph 39 " ...If the methane emissions from anaerobic decay of the final sludge were to be neglected because the sludge is controlled combusted, disposed 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....".
6. Quantity of fossil fuel used in the project activity along with biogas shall be direct monitored using continuous flow meter as described in the validated VCS PD.

These issues have been **raised as FAR #26** for the further necessary action in the next monitoring period.

6. Overview of Results

Is the project documentation in accordance with the requirements of VCS2007.1?

Yes. The results of the compliance assessment are recorded in the verification checklist which is used as an internal report only.

Have on-site inspections been performed that may comprise, inter alia, a review of performance records, interviews with project proponents and local stakeholders, collection of measurements, observations of established practices and testing of the accuracy of monitoring equipment?

Yes. Members of the Assessment team visited the sites and undertook interviews, collected data, audited the implementation of procedures, checked calibration certificates and checked data, inter alia.

The results of the site visits are recorded in the verification checklist which is used as an internal report only.

The evidences have been checked and collected. The revised monitoring report is attached with this verification report.

Has data from additional sources been used? If yes, please detail the source and significance.

Yes, the additional data has been reviewed. The values from the validated VCS PD have been used which some values need to be verified again as not adopted from the methodologies, tools and IPCC. Description to these values has been described under section 2.3.5 of this verification report

Please review the monitoring results and verify that the monitoring methodologies for the estimation of reductions in anthropogenic emissions by sources have been applied correctly and their documentation is complete and transparent.

No. Some of the monitoring methodology has not been correctly applied as per the requirement of applicable methodologies.

- Quantity of biogas sent to flare was not quantified by metering but obtained from calculation
- Final sludge disposal: no monitoring data reported
- Thermal energy generated from project activity: no direct monitoring in thermal energy
- Flame and/or temperature was not being monitored
- No direct measurement of the CH₄ content in the biogas.
- No direct monitoring of the fossil fuel fired along with biogas in the boiler.

However, the deviation to the methodologies is explained in the section 3.2 of this verification report and found that the deviation is on the conservative manner and has no impact in increasing in emission reduction. The monitoring report and supporting references are complete and transparent.

Have any recommendations for changes to the monitoring methodology for any future crediting period been issued to the project proponent?

No recommendation has been given to project proponent regarding the change in the monitoring plan mentioned in the validated VCS PD. But the monitoring plans mentioned in the validated VCS PD have to be followed and implemented in the project activity.

Determine the reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the VCS project activity, based on the data and information using calculation procedures consistent with those contained in the registered project design document and the monitoring plan.

The data used in anthropogenic emission reduction calculation is consistent with those contained in the validated VCS PD and monitoring plan. The emission reduction was 50,688 tCO₂ for the period 28/03/2006 to 31/12/2008 as per the estimation made in the Validated VCS PD (33 months). The

actual emission reduction has been verified as **39,137** tCO₂ for the same period. The variation in the estimated and actual emission reduction is discussed in the section 3.4 of the report.

Identify and inform the project proponents of any concerns related to the conformity of the actual project activity and its operation with the registered project description document. Project proponents shall address the concerns and supply relevant additional information.

“No such non conformity of the actual project activity and its operation with the registered project description document has been observed.”

7. Verification Conclusion

SGS United Kingdom Ltd has been contracted by South Pole Carbon Asset Management Ltd. to examine the greenhouse gas (GHG) emission reductions reported from the “SD Biosupply Wastewater Treatment and Biogas Utilization Project”, for the period, 28/03/2006 up to 31/12/2008 equating to 39,137 tonnes of CO₂ equivalents. Our opinion relates to the project’s GHG emissions and resulting GHG emissions reductions reported for the period and the verification testing conducted against the GHG Assertion.

The management of South Pole Carbon Asset Management Ltd is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Monitoring Report version 11 dated 20/08/2010. Calculation and determination of GHG emission reductions from the project is the responsibility of the management of the “SD Biosupply Wastewater Treatment and Biogas Utilization Project”. The development and maintenance of records and reporting procedures are in accordance with the monitoring report.

It is SGS’ responsibility to express an independent GHG verification opinion on the GHG emissions from the project for the period 28/03/2006 up to 31/12/2008 and on the calculation of GHG emission reductions from the project based on the verified emissions for the same.

The verification approach was based on the requirements as defined in Voluntary Carbon Standard VCS 2007.1. Our approach is risk-based, drawing on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these. Our examination includes assessment, on a test basis, of evidence relevant to the amounts and disclosures in relation to the project’s GHG emission reductions for the period 28/03/2006 up to 31/12/2008. We 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 the amount of GHG emission reductions for the period 28/03/2006 up to 31/12/2008, prepared on the basis of the Monitoring Report Version 11 dated 20/08/2010, are fairly stated. We conducted our verification with regard to the client’s GHG projects Validated VCS PD and monitoring report which included “SD Biosupply Wastewater Treatment and Biogas Utilization Project” at project plan, baseline applied and baseline GHG emissions or removals, Monitoring and Verification Plan, GHG Emission reduction, removal enhancements. This assessment included collection of evidence supporting the reported data checking whether the provisions of the Monitoring and Verification Plan in the Validated VCS PD were consistently and appropriately applied

We have verified whether the information included in the monitoring report representing the project baseline is current and has been extracted from the project site and the emission reduction achieved has been determined by correctly subtracting emissions for the monitoring period 28/03/2006 up to 31/12/2008 from the baseline figures for the comparable

Reporting Period: From 28/03/2006 up to 31/12/2008

Verified emission in the above reporting period:

Project Emissions:	26,741	tCO ₂ equivalents
Baseline Emissions:	65,878	tCO ₂ equivalents
Emission Reductions	39,137	tCO ₂ equivalents

Based on process and procedures conducted, in our opinion, assertion on GHG emission reductions for the “SD Biosupply Wastewater Treatment and Biogas Utilization Project” project during the reporting period 28/03/2006 to 31/12/2008 is materially correct and is a fair representation of the GHG data and information and the emission reductions are fairly stated. The GHG emission reductions were calculated correctly on the basis of approved monitoring methodology AMS III.H, Version 12 valid from 11/06/2009 – 30/07/2009 and AMS I.C, Version 14 valid from 08/04/2009 – 30/07/2009.

SGS confirms that the project is implemented as described in the validated and registered project design documents. Based on the information we have seen and evaluated, we confirm the following:

Project Title:	"SD Biosupply Wastewater Treatment and Biogas Utilization Project"
UNFCCC Reference Number:	Not applicable as this project not applied for CDM registration. However VCS Project ID is 416
Validated VCS PD Used for Verification:	Version 6.4, dated 19/11/2009
Methodology Used for Verification:	AMS III.H, Version 12 valid from 11/06/2009 – 30/07/2009 and AMS I.C, Version 14 valid from 08/04/2009 – 30/07/2009
Applicable Period:	28/03/2006 up to 31/12/2008
Total GHG Emission Reductions Verified:	Total = 39,137 VCUs 28/03/2006 up to 31/12/2006 = 10,137 VCUs 01/01/2007 up to 31/12/2007 = 14,308 VCUs 01/01/2008 up to 31/12/2008 = 14,692 VCUs

Technical Reviewer

Signature:



Name: Ramkrishna Patil

Date: 23/08/2010

Lead Assessor

Signature:



Name: Pitipoom Tungsirisuteekul

Date: 20/08/2010

8. Document References

- /1/ Validated VCS PD version 6.4 Dated 19/11/2009 (weblink : https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/Project_ViewFile.asp?FileID=3714&IDKEY=9kjalskif098234kj28098sfkjl098098kl32lasjdfk909a5121606)
- /2/ Validation Report for CCP.VOL0307, issued by SGS, dated 19/11/2009 (weblink : https://vcsprojectdatabase1.apx.com/mymodule/ProjectDoc/Project_ViewFile.asp?FileID=3715&IDKEY=qlksjoiuwqowrnoiuomnckjashoufifmIn902309ksdfiku098k5122985)
- /3/ AMS.III.H Version 12, valid from 11/06/2009 – 30/07/2009
- /4/ AMS.I.C Version 14, valid from 08/04/2009 – 30/07/2009
- /5/ SD Biosupply operating License, reference number Por 10/2548, dated 10/06/2005
- /6/ SD Technical proposal and turnkey contract, issued by PAPOP, dated 06/10/2004
- /7/ SD Organization chart, latest version available during site visit
- /8/ SD Calibration plan 2009, signed and approved by biogas plant manager
- /9/ SD Calibration Certificate of FM1 : wastewater flow meter, serial number 6B00F220000, dated 08/12/2004, 25/03/2008 and 17/03/2009
- /10/ SD Calibration Certificate of GM1 : quantity of biogas captured, serial number C9 - 9086 , dated 15/11/2004
- /11/ SD Calibration Certificate of GM1 : quantity of biogas captured, serial number 6571, dated 05/09/2008
- /12/ SD Calibration Certificate of GM2 : quantity of biogas sent to boiler, serial number EJ-10209, dated 26/02/2005
- /13/ SD COD Colorimeter test, dated 06/05/2008
- /14/ SD Sludge from UASB Tank ; calculation method with the significant criteria to estimate excess sludge generated in UASB
- /15/ SD Electricity consumption and bill covered the monitoring period (2006-2008).
- /16/ SD NCV IPCC Guidelines, Volume 2 Chapter 1 for the NCV applied in the project activity.
- /17/ Calculation of grid emission factor as the excel sheet
- /18/ SD Emission Factor-dede_2007, final figure at 0.501 tCO₂/MWh
- /19/ SD HFO and starch prod presented as the internal record for year 2006 - 2008, issued by Somdej Flour Mill Co.,Ltd
- /20/ The calibration report of chemical substance use in COD colorimeter
- /21/ Monitoring and Emission reduction calculation spreadsheet Dated 22/04/2010
- /22/ Monitoring Report version 1, Dated 30/03/2008 (MP 28/03/2006 – 31/12/2007)
- /23/ Monitoring Report version 3, Dated 19/02/2009 (MP 28/03/2006 – 31/12/2008)
- /24/ Monitoring Report Version 11, Dated 20/08/2010 (MP 28/03/2006 – 31/12/2008)
- /25/ Flare operation manual, prepared by PAPOP, available in both Thai and English
- /26/ Declaration letter on the commissioning date of project activity on 18/12/2005, letter dated 25/12/2005
- /27/ Internal plan logsheet to substantiate in the start date of project activity, logsheet start record on 18/08/2005
- /28/ Site visit, opening and closing meeting attendance list on 10/04/2008 and 12/03/2009

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