
Verification and Certification Report

Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.

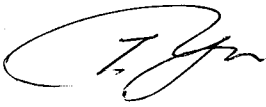
**Jaroensompong Corporation
Rachathewa Landfill Gas to Energy
Project
(Ref. 1413)**

Project No. JQA-C0251
(No. 1812000489-491)

29 August 2013



JAPAN QUALITY ASSURANCE ORGANIZATION

Verification and Certification Report		Project Title: Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project	
Issuance Date: 29/08/2013 (ver. 2.0)		Applied Methodology: ACM 0001 (ver. 05)	
Project No.: JQA-C0251 (No.1812000489-491)		Registration Date: 14/03/2008	Ref. 1413
Client: Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.		Project Participants: <ul style="list-style-type: none"> - Jaroensompong Co., Ltd. (Thailand) - Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (Japan) 	
Second Monitoring Period: 01/01/2009 - 31/12/2012			
Monitoring Report: <ul style="list-style-type: none"> - First version and date: ver. 1.0, 12/06/2013 - Date of making publicly available on the UNFCCC website: 12/06/2013 - Revised version and date: ver.3.0, 14/08/2013 			
Verified Amount of Emission Reductions for the Monitoring Period: 126,264 tCO ₂ e			
<p>Summary:</p> <p>JQA performed the 2nd periodic verification of the emission reductions achieved by the registered CDM project activity "Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project" (Ref. 1413) under the contract with Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. The 2nd periodic verification covers the monitoring period from 01/01/2009 to 31/12/2012 which is within the fixed crediting period between 14/03/2008 and 13/03/2018 (10 years).</p> <p>As a result of the verification, JQA confirms that the project has been implemented and operated in accordance with the approved revised PDD. The GHGs emission reductions determined in revised Monitoring Report and revised ER calculation spreadsheet have been achieved in accordance with the monitoring plan of the approved revised PDD. Based on the results of the desk review of relevant documents and the on-site assessment, JQA confirms the following statement:</p> <p>Certified emission reductions verified in the 2nd monitoring period between 01/01/2009 and 31/12/2012 are 126,264 tCO₂e.</p>			
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Approved by Senior Executive: <div style="text-align: center;">  Tadayuki Yano </div>			

Abbreviations

BE	Baseline Emissions
BMA	Bangkok Metropolitan Area
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CL	Clarification Request
CMP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
COP/MOP	Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
DOE	Designated Operational Entity
DR	Desk Review
EB	CDM Executive Board
EF	Emission Factor
ER	Emission Reductions
FAR	Forward Action Request
GHGs	Greenhouse Gases
HDPE	High-density polyethylene
ISO	International Organization for Standardization
JQA	Japan Quality Assurance Organization
LFG	Landfill gas
MEA	Metropolitan Electricity Authority
MP	Monitoring Plan
MR	Monitoring Report
NCV	Net Calorific Value
OA	On-site Assessment
PDD	Project Design Document
PE	Project Emissions
PP	Project Participant
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance and Quality Control
SOP	Standard Operational Procedure
STP	Standard temperature and pressure (0 degree Celsius and 1,013 bar)
TISI	Thai Industrial Standards Institute, Ministry of Industry
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Clean Development Mechanism Validation and Verification Standard

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1. INTRODUCTION

Japan Quality Assurance Organization (hereinafter JQA) has performed the 2nd periodic verification of the registered CDM project “Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project” (hereinafter the CDM Project) under the contract with Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. The CDM Project has been implemented by Jaroensompong Co., Ltd. (hereinafter JS) (Thailand) and Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (Japan). Monitoring Report (ver. 1.0) prepared by Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. was issued on 12/06/2013 and was made publicly available on 12/06/2013 on the UNFCCC website. Monitoring Report (ver. 3.0) was issued on 14/08/2013 (**Ref. 1**).

This Verification and Certification Report describes the processes and findings in the verification of the CDM Project and states the GHG emission reductions achieved during the 2nd monitoring period between 01/01/2009 and 31/12/2012 within the fixed crediting period between 14/03/2008 and 13/03/2018.

1.1 Objective

Verification is the periodic independent review and *ex-post* determination by a DOE of the monitored reductions in anthropogenic emissions by sources of GHGs that have occurred as a result of a registered CDM Project activity during the verification period. Certification is the written assurance by a DOE that, during a specified time period, a project activity achieved the reductions in anthropogenic emissions by source of greenhouse gases as verified. (Para 61 of the Modalities and Procedures for a clean development mechanism as defined in Article 12 of the Kyoto Protocol (Decision 3/CMP.1)).

According to the VVS (ver. 04.0), the verification process includes the activities aiming to:

- (a) Determine whether the project activity has been implemented and operated as per the registered PDD or any approved revised PDD, and that all physical features (technology, project equipments, and monitoring and metering equipment) of the project are in place;
- (b) Determine whether the monitoring report and other supporting documents provided are complete in accordance with latest applicable version of the completeness checklist for requests for issuance of CERs, verifiable, and in accordance with applicable CDM requirements;
- (c) Determine whether actual monitoring systems and procedures comply with the monitoring systems and procedures described in the monitoring plan or any revised approved monitoring plan, and the approved methodology including applicable tool(s),

- (d) Evaluate the data recorded and stored as per the monitoring methodology including applicable tool(s).

1.2 Scope

Monitoring Report (ver. 1.0, 12/06/2013, hereinafter the MR; ver. 3.0, 14/08/2013, hereinafter the revised MR) (**Ref. 1**) including the ER calculation spreadsheet (**Ref. 2**) which summarizes information regarding GHGs emission reductions achieved during the 2nd monitoring period were reviewed against:

- Decisions by UNFCCC
- Kyoto Protocol
- Decisions 3 / CMP 1
- Relevant decisions of COP/MOP and CDM-EB
- CDM Validation and Verification Standard (VVS) (ver. 04.0)
- CDM Project Standard (PS) (ver. 04.0)

The MR and the ER calculation spreadsheet are also assessed to confirm their conformity with the following documents:

- Project Design Document (PDD), ver. 03 (**Ref. 3**)
- Validation Report, Report No. 2007-1017 (**Ref. 4**)
- Approved revised PDD, ver. 03.6 (**Ref. 5**)
- ACM 0001, ver. 05 (Sectoral Scope 13)
- AMS-I.D, ver. 11
- Tool to determine project emissions from flaring gases containing methane (EB28, Annex 13) (hereinafter Flare Tool)

1.3 Project description

The CDM Project has installed a landfill gas (LFG) collection system and a 1.1 MW gas engine generator at the Rachathewa landfill site which is located about 30 km east of Bangkok Metropolitan Area (BMA), Thailand. Recovered LFG is consumed for the generation of electricity which is sold to the Metropolitan Electricity Authority (MEA) grid company. The Project has also installed an open flare system to combust excess LFG. The Project is the first in Thailand to utilize LFG for electricity generation on a commercial scale and contributes to reduce GHG emissions from the landfill site into the atmosphere. Currently, there is no regulation for LFG collection/combustion in Thailand. The CDM Project is expected to reduce annual average of 51,830 tCO₂e by the collection and combustion of LFG and further by displacing the fossil fuel consumption in the grid electricity system with LFG for electricity generation.

The CDM Project was registered by the CDM EB on 14/03/2008 (Ref. 1413). The capacity of electricity generator was changed from 1.0 MW to 1.1 MW by post registration changes

(PRC-1413-001) and was approved by the CDM EB on 02/04/2013. The PPs selected 10 -years fixed crediting period from 14/03/2008 to 13/03/2018.

1.4 Verification team and technical reviewers

The verification team and technical reviewers were assigned on 11/06/2013 based on the latest JQA CDM Quality Manual at that time. The coverage of technical area by the team and technical reviewer granted by the criteria of the latest JQA CDM Quality Manual are shown in Table 1. Their certificates are attached to this report (Appendix B) and their expertise and experience are also attached to this report (Appendix C).

Table 1 Verification team members and Technical Reviewer

Name	Qualification ¹⁾	Task ²⁾	Coverage of Technical Area	Local Expertise	OA Participation
Tadashi Yoshida	TLA	TL	13.1	✓	✓
Hiroshi Motokawa	A	TM	13.1	✓	✓
Tritib Suramaythangkoor	A	TE	1.1	✓	✓
Akiko Furuya	-	TR	13.1	✓	
Hiroshi Kobayashi	-	TR	1.1	✓	

1) TLA: Team Leader Assessor; A: Assessor

2) TL: Team Leader, TM: Team Member, TE: Technical Expert, TR: Technical Reviewer

The verification team and the technical reviewers cover the sectoral scopes 1 and 13 defined by the applied methodologies and necessary technical areas 1.1 and 13.1.

The roles and responsibilities of the team leader are mainly to prepare the verification plan including the desk review and the on-site assessment, and to manage the verification activities of the team. The team leader is also responsible for the description of the verification and certification statements in the final Verification and Certification Report.

The roles and responsibilities of the team member are to perform the desk review and the on-site assessment including the investigation of background information and interviews with the PPs and relevant stakeholders, and also to indicate potential Corrective Action Requests (CARs), Clarification Requests (CLs) and/or Forward Action Requests (FARs).

The on-site assessment (OA) was implemented by the team members on 17-18/07/2013, and after the OA the CDM Verification Checklist indicating CARs and CLs was submitted to the PPs on 24/07/2013.

2. VERIFICATION PROCESS

2.1 Verification process

The verification process of JQA consists of the following steps:

- 1) Desk review of relevant documents including Monitoring Report provided from the PPs;
- 2) Materiality assessment and preparation of verification and sampling plan;
- 3) On-site assessment including site-tour, interview with the relevant personnel, cross-check of the data and the calculation for GHG emission reductions, and identification of the PPs' quality control and the quality assurance procedures;
- 4) Resolution of corrective action requests (CARs) and clarification requests (CLs); In case that forward action requests (FARs) are raised, the PPs are expected to address the issues for the next verification period;
- 5) Preparation of the draft Verification and Certification Report;
- 6) Internal quality control (Technical Review), and
- 7) Decision on the issuance of Verification and Certification Report

In order to ensure transparency, CDM Verification Checklist is prepared for the project according to VVS and decisions/guidelines issued by the CDM-EB. The applied Checklist is attached as Appendix A to this report. Issues or findings identified in the verification process are indicated under the titles "CAR", "CL" or "FAR" in the Checklist. CAR requires the PPs to take corrective action without fail, while CL indicates that the PPs are requested to make clarifications and/or amendments.

According to the VVS, the criteria for CAR, CL and FAR are as follows:

CAR (Corrective Action Request)

- a) Non-conformities with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the PPs, or if the evidence provided to prove conformity is insufficient;
- b) Modifications to the implementation, operation and monitoring of the registered project activity has not been sufficiently documented by the PPs;
- c) Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;
- d) Issues identified in a FAR during validation to be verified during verification or previous verification(s) have not been resolved by the PPs.

CL (Clarification Request)

- a) Information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

FAR (Forward Action Request)

- a) The monitoring and reporting require attention and/or adjustment for the next verification period.

Finally, all issues are listed in Table 2 and Table 3 of the CDM Verification Checklist (Appendix A), and the solution of CARs and CLs raised during the 2nd verification through the PP's correspondences is summarized in Table 4 of the CDM Verification Checklist (Appendix A).

2.2 Desk review of relevant documents

In line with the VVS (ver. 04.0), the following documents were reviewed by comparing with the approved revised PDD (**Ref. 5**) and applied methodologies:

- Monitoring Report (ver. 1.0 and ver. 3.0) (**Ref. 1**)
- ER calculation spreadsheet (ver. 1.0 and ver. 3.0) (**Ref. 2**),

No FARs were raised in the 1st verification. The documentary evidences necessary for the 2nd periodic verification were also provided in response to the JQA's request. The findings obtained through the desk review of these documents and the OA are listed in Table 2 and Table 3 of the CDM Verification Checklist (Appendix A).

2.3 Materiality and Sampling plan

In accordance with Para 16 of "Guideline on the application of materiality in verifications" (ver. 01.0), JQA considered materiality in planning of the verification based on the following steps:

- (a) Identify the materiality threshold according to Para 10 of the guideline that corresponds to the amount of emission reductions or removals the specific type of CDM project activity will achieve;
- (b) Understand the environment in which the project activity operates, the sources of project emissions within the project boundary and the leakage, the monitoring activities, the equipment used to monitor or measure activity data, the origin and application of data used to calculate or measure the emissions, data flow, the internal quality control system, and the overall organization with respect to monitoring and reporting;
- (c) Conduct a risk assessment to identify and assess the risks of individual or aggregated material errors, omissions or misstatements that may occur within the threshold based on elements in subparagraphs (a) and (b) above;
- (d) Design verification and sampling plans and audit procedures whose type, timing and extent are based on and are responsive to the assessed risks of material errors, omissions or misstatements.

The materiality threshold, risk assessment and the corresponding verification and sampling plans designed for the 2nd periodic verification is summarized in Section 3.5.1.

2.4 On-site assessment (OA)

In line with the VVS, the OA was performed to verify the monitoring data and project implementation in comparison with the approved revised PDD. During the OA, JQA received additional documentary evidences from the PPs. Through the OA, JQA examined documents, facilities and instruments to check whether the project activity had been implemented and operated as per the approved revised PDD and monitoring plan and whether all physical features (technology, project equipment, and monitoring and metering equipment) of the project were in place. JQA also performed the data cross-check and the interview with the PPs to confirm monitoring activities, information flows and QA/QC procedures.

Tables 2 and 3 of the CDM Verification Checklist (Appendix A) indicating the findings obtained and CARs/CLs raised through the desk review of relevant documents and the OA were submitted to the PPs.

2.5 Resolution of CARs / CLs / FARs

The PPs responded to the CARs/CLs raised during the verification. JQA reviewed the revised MR and the revised ER calculation spreadsheet prepared after the OA and the relevant additional documentary evidences, and confirmed that all the CARs/CLs were resolved. Details of resolution process of CARs and CLs are shown in Table 4 of the CDM Verification Checklist (Appendix A).

2.6 Draft Verification and Certification Report

The Draft Verification and Certification Report was prepared based on the results of the desk review of the relevant documents, the on-site assessment and the clarification / resolution of CARs and CLs raised in the 2nd verification. To ensure transparency, the final conclusion was made by using CDM Verification Checklist (Appendix A) which contained the necessary requirements based on VVS (ver. 04.0) and decisions/ guidelines issued by the CDM-EB.

2.7 Internal Quality Control and final approval

Draft Verification and Certification Report and CDM Verification Checklist were assessed by technical reviewers in line with the latest Procedure for Internal Quality Control of JQA. The appropriateness of the draft conclusions on the verification of the CDM Project and its procedures were reviewed from technical points of view. The technical reviewers inform the review results to the verification team. The verification team responds to the technical reviewers' comments and revises the Draft Verification and Certification Report, if necessary. The results of the review are informed to the Manager of CDM/JI Assessment Division.

The Manager of CDM/JI Assessment Division reports the review result to the Senior Executive of JQA. Finally, the Senior Executive approves the validity of emission reductions achieved by the approved revised CDM Project and issues the Verification and Certification Report.

3. RESULTS OF VERIFICATION

The findings including five CARs and ten CLs raised in the 2nd verification and the resolution of these CARs/CLs are described in this Chapter.

3.1 Compliance of the project implementation with the approved revised PDD

3.1.1 Implementation status of the CDM Project

Jaroensompong Co., Ltd. (hereinafter JS) has installed LFG collection system equipped with blowers and a 1.1 MW gas engine generator at the Rachathewa landfill site to utilize the LFG for electricity generation (**Refs. 6, 7**). There is no use of the LFG for the generation of thermal energy in the project activity. Currently, there are no requirements for the collection / combustion of LFG in Thailand (**Ref. 8**) and the CDM Project is the first case in Thailand to utilize LFG for electricity generation on a commercial scale. The LFG collection system is based on the horizontal lines and wells (**Ref. 9**), and the LFG recovered by the blower is utilized for the generation of electricity which is sold to the Metropolitan Electricity Authority (MEA) grid company under a power purchase agreement (PPA) (**Ref. 10**). The Project has also installed an open flare system to combust excess LFG to avoid the release of collected LFG into the atmosphere (**Ref. 11**).

According to the approved revised PDD, the landfill site of the CDM Project (Site-1) is located adjacent to another landfill site (Site-2). It is confirmed through the observation of the landfill sites and the interview with the PPs that the LFG collection system is not installed at Site-2 and further Site-1 is away more than 50 m from Site-2 (**Ref. 12**). Therefore, JQA concludes that the LFG utilized in the CDM Project is collected from Site-1 only and the collection of LFG from Site-1 is not affected by the existence of Site-2.

JQA confirms that the CDM Project consists of only one site and is not phased implementation. The start date of the CDM Project was 01/08/2004, in which JS entered into a construction contract with a local engineering company (**Ref. 13**). The construction of the LFG collection system was completed on 30/06/2005 and the plant facility except gas engine generator was commissioned on 11/08/2005 (**Ref. 11**). The gas engine generator was commissioned on 02/03/2006 (**Refs. 14-16**) and the continued operation of the CDM Project started on 03/03/2006 (**Refs. 16, 17**).

The capacity of gas engine generator was changed from 1.0 MW to 1.1 MW by post registration changes (PRC-1413-001) in the 1st verification and was approved by the CDM EB on 02/04/2013. The PPs selected 10-years fixed crediting period from 14/03/2008 to 13/03/2018.

Regarding the commissioning date of the project plants in A.1, CL 01 was raised and resolved as follows:

CL 01: The commissioning date of the project plants is not included in Section A.1 of the MR.

Resolution: It is confirmed that the commissioning date of the project plant is

added in Section A.1 of the revised MR.

3.1.2 Actual operation

In addition to the regular maintenance of the plant facility every 2 weeks, JS experienced some shutdowns due to the overhaul maintenance of the gas engine generator in Oct 2009 and Mar-May 2011, technical problems such as the malfunctions of engine ignition system and engine gas system, and the replacement of engine cylinder head, during the 2nd monitoring period (**Ref. 18**).

Through the review of monitoring records and the interview with the PPs, JQA confirms that the project facility was not running in full operation and the operation rate was about 92 % ($= 32,173\text{h} \times 100 / (8,760 \times 4 \text{ yr})$) throughout the 2nd monitoring period.

The CDM Project has collected the LFG of 18,197,699 Nm³ by the collection system during the 2nd monitoring period. The moisture in the LFG is removed by the scrubber located upstream of the blower and about 1 liter moisture per day was removed during the 2nd monitoring period. Then, the LFG is sucked by the blower to supply it to the gas engine generator and the open flare (**Ref. 19**). During the 2nd monitoring period, most of the LFG has been sent to the gas engine generator and therefore the open flare system has been rarely operated.

The monitoring data of the LFG collection activity shows that the concentration of methane in the LFG has been in a range of 35-55 % and the temperature of the LFG measured at the inlet of blower was about 30°C on average during the 2nd monitoring period. As the temperature of the LFG is lower than 60°C, it is not necessary to ensure that the same basis (wet or dry) is considered for measurement of volumetric fraction of methane and biogas flow rate in accordance with “Flare Tool”. The temperature of the LFG at the outlet of the blower is elevated up to 55-70°C by compression heat, and then the LFG is fed to the gas engine generator after cooling down to enhance the generation efficiency of the gas engine (**Ref. 19**).

It is confirmed through the observation and the interview with the PPs that there is no captive power plant for emergency use other than the gas engine generator of the Project. Accordingly, all electricity for the operation of the project plants and equipment is supplied from the gas engine generator or the MEA grid line.

Furthermore, it is confirmed through the observation and the interview with the PPs that there was no use of fossil fuel to meet the thermal energy requirements on-site and there was no use of the LFG for the generation of thermal energy.

3.1.3 Installed equipment

The approved revised PDD states that the following systems are installed by the CDM Project.

- LFG collection system consisting of horizontal lines and wells and gas blowers
- LFG utilization system consisting of gas engine generator
- Flaring system consisting of open flare with flame detectors

Table 2 summarizes the specifications of the main equipments which are installed and operated for the CDM Project.

Table 2 Main specification of CDM Project equipments

Gas blower	
Manufacturer	Dresser Roots Holmes Operation, UK
Model	Urai 56-G
Flow rate	800 m ³ /hr
Gas engine generator	
Manufacturer	Caterpillar
Model	3516
Rated power output	1,100 kW (1,375 kVA x 0.8)
Flare	
Type	Open flare with flame detectors
Flow range	0 – 800 m ³ /hr

Through the review of purchase contracts (**Refs. 11, 13, 14**), the on-site inspection and the interview with the PPs, JQA confirms that all the systems above are actually installed and operated in accordance with the approved revised PDD.

Regarding the implementation status and technical information of the project activity, CL 02, CL 03 and CL 07 were raised and resolved as follows:

CL 02: The implementation status of the project activity such as events or situations that occurred during this monitoring period is not detailed in Section B.1 of the MR.

Resolution: It is confirmed that the summary of major shutdown and events during the 2nd monitoring period is added in Section B.1 of the revised MR.

CL 03: The relevant information on the installed technology(ies), technical process and main specification of equipment is not included in Section B.1 of the MR.

Resolution: It is confirmed that LFG collection system with blower, LFG utilization system including gas engine generator, open flaring system are described in Section B.1 of the revised MR.

CL 07: 1) No use of the LFG for the generation of thermal energy is confirmed through the on-site assessment, but this information is not clearly reflected in Sections A.1 and E.1 of the MR.

2) No use of fossil fuel on-site is confirmed through the on-site assessment, but this information is not clearly reflected in Sections D.2 and E.1 of the revised MR.

Resolution : 1) It is confirmed that “The project does not involve direct utilization of LFG for thermal use” is clearly added in Sections A.1 and E.1.

2) It is confirmed that the description relevant to no use of fossil fuel on-site is

added in Sections A.1, D.2, E.1 and E.2 of the revised MR.

Through the review of the relevant documents, on-site inspection and interview with the PPs, JQA confirms that all the systems are actually installed and the CDM Project, which is generation of electricity using LFG, has been implemented and operated in accordance with the approved revised PDD.

3.2 Compliance of the monitoring plan with the monitoring Methodology

Through the desk review of the relevant documents, JQA confirms that the approved revised monitoring plan is fully consistent with the approved methodology ACM0001 (ver. 05) applied to the CDM Project. Further revision of the monitoring plan is not required for the CDM Project.

3.3 Compliance of monitoring activities with the revised monitoring plan

3.3.1 Monitoring parameters and procedures

Sixteen monitoring parameters are prescribed in the approved revised monitoring plan (**Refs. 5, 19**). Among them, “Regulatory requirements” relating to the collection / combustion of LFG in Thailand is to be recorded annually and changed at the renewal of crediting period. As there is no regulatory or contractual requirements for LFG collection / combustion in Thailand at the time of project registration, the adjustment factor (AF) is determined to be zero in the CDM Project. ET_y (Thermal energy used in landfill during project) and $CEF_{thermal,y}$ (CO_2 emission intensity of the thermal energy) were also not measured during the 2nd monitoring period because the fossil fuels are not used for the generation of thermal energy in the CDM Project.

The process flow diagram of the project plant with monitoring parameters and points is illustrated in Figure 1.

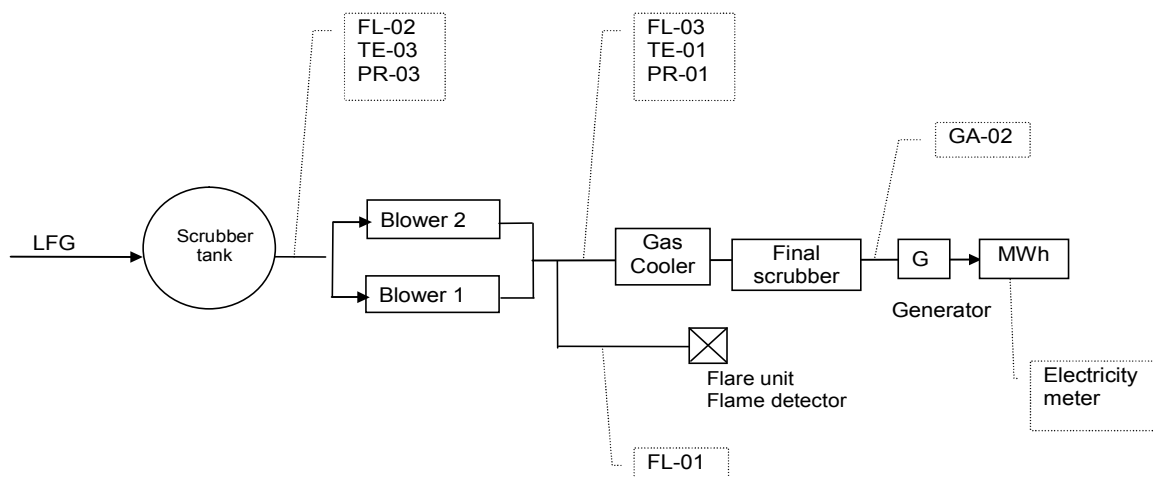


Figure 1 Process flow diagram of the project plant with monitoring parameters and points

Regarding the flow data of the LFG, following three parameters are continuously measured by flow meters:

- $LFG_{total,y}$: Total amount of landfill gas captured, m^3 at STP (0 °C, 1 bar).
- $LFG_{flare,y}$: Amount of landfill gas flared, m^3 at STP (0 °C, 1 bar).
- $LFG_{electricity,y}$: Amount of biogas combusted in power plant, m^3 at STP (0 °C, 1 bar).

These parameters are continuously measured by flow meters and logged on minutely basis by Data Acquisition System and then aggregated hourly, monthly and yearly, in accordance with the approved revised monitoring plan.

T (Temperature of the landfill gas) and P (Pressure of the landfill gas) are to be used to determine the density of methane (D_{CH_4}) in the methodology ACM 0001 (ver. 05), but the density of methane ($0.0007168 \text{ tCH}_4/\text{m}^3\text{CH}_4$) at standard temperature and pressure (0 °C, 1.013 bar) is actually used in the CDM Project according to the methodology.

The monitored temperature and pressure data (TE-01, TE-03, PR-01 and PR-03) are used to convert the monitored LFG volume to normalized volume at the designed condition for the flow meter, which is at 15°C and 1 bar. The normalized flow data are further converted to STP (0°C and 1 bar) specified by the methodology, to determine $LFG_{total,y}$, $LFG_{flare,y}$ and $LFG_{electricity,y}$. These parameters are continuously measured by the thermocouple and pressure transmitter, respectively, at the two points of inlet and outlet of the blower. They are logged on minutely basis by Data Acquisition System and then aggregated hourly, monthly and yearly. The temperature of the LFG is around 30°C at TE-03, but is elevated by compression heat caused by the blower at TE-01. The pressure of the LFG is negative at PR-03 and positive at PR-01 by the operation of the blower.

$w_{CH_4,y}$ (Methane fraction in the landfill gas, $m^3\text{CH}_4/\text{m}^3\text{LFG}$) is continuously measured on wet basis by an infrared methane analyzer located at the inlet of gas engine generator.

The data is logged on minutely basis by Data Acquisition System and then aggregated hourly and monthly.

Regarding the flare operation, following parameters are continuously measured or calculated on minutely basis:

- $fv_{CH_4,h}$: Volumetric fraction of CH_4 in the residual gas in the hour h , -. Hourly data of $w_{CH_4,y}$ is used for this parameter.
- $FV_{RG,h}$: Volumetric flow rate of the residual gas in dry basis at normal condition in the hour h , m^3/h . According to the “Flare tool”, this parameter is calculated on hourly basis from the monitored data of $LFG_{flare,y}$.
- Flare operation parameter: Minutes that flare is detected during the hour h . Flame is continuously detected by flame detector and the signal is logged on minutely basis by Data Acquisition System. If the flame is not detected for more than 20 minutes during the hour h , 0% of the flame efficiency ($\eta_{flare,h}$) is applied for the hour h , in accordance with the approved revised monitoring plan and “Flare tool”. The number of hours in which the flame is detected for more than 20 minutes is automatically counted by a flame detection system. As most of the LFG was used for electricity generation during the 2nd monitoring period, 0% of the flame efficiency was applied throughout the whole 2nd monitoring period.
- $PE_{flare,y}$: Project emissions from flaring of the residual gas stream in year y , tCO_2e . This parameter is calculated by Equations (13) and (15) in the “Flare tool” using the calculated/monitored data of $FV_{RG,h}$, $fv_{CH_4,h}$, $\eta_{flare,h}$ and the default values of GWP_{CH_4} and $p_{CH_4,n}$ ($=D_{CH_4} \times 10^3$).

Regarding the electricity data, following parameters are continuously measured by electricity meter and manually recorded on monthly basis:

- $E_{EX,LFG}$: Total amount of electricity exported out of the project boundary, MWh.
- E_{IMP} : Total amount of electricity imported to meet project requirement, MWh.

The amount of electricity generation by the gas engine generator is continuously monitored and manually logged by the operation staff every half hour. The data is used for the operation management of the gas engine generator and for cross-checking the data of $E_{EX,LFG}$ measured by the MEA electricity meter.

Finally, the operating hour of the gas engine generator is counted and recorded annually. The parameter is used to ensure methane destruction when methane is used for electricity plant in operation.

Regarding the process flow diagram and measurement procedures, CAR 01 and CL 08 were raised and resolved as follows:

CAR 01: The process flow diagram with monitoring parameters and points is not described in Section C of the MR.

Resolution: It is confirmed that the process flow diagram with monitoring parameters and points is appropriately added in Section C of the revised MR.

CL 08: 1) Recording frequencies of $LFG_{total,y}$, $LFG_{flare,y}$, $LFG_{electricity,y}$, $w_{CH_4,y}$, T and P are not clearly described.

2) The description on the measurement conditions (dry or wet) when the residual gas temperature exceeds 60°C is not included for the parameter of $fv_{CH_4,h}$.

Resolution: 1) It is confirmed that the recording frequencies of $LFG_{total,y}$, $LFG_{flare,y}$, $LFG_{electricity,y}$, $w_{CH_4,y}$, T and P are added in the revised MR.

2) It is confirmed that the measurement condition of $fv_{CH_4,h}$ is added in the revised MR.

Through the review of monitored data provided by the PPs, JQA confirms that all monitoring parameters are appropriately measured and calculated in accordance with the approved revised monitoring plan.

3.3.2 Monitoring equipment

Following five kinds of monitoring / analysis equipment are used for the CDM Project.

- Flow meters for $LFG_{total,y}$ (FL-02), $LFG_{flare,y}$ (FL-01) and $LFG_{electricity}$ (FL-03)
- Thermocouple for T (TE-01 and TE-03)
- Pressure transmitter for P (PR-01 and PR-03)
- Methane analyzer for $w_{CH_4,y}$ (GA-02) and $fv_{CH_4,h}$ (GA-02)
- Electricity meter for E_{LFG} and E_{LIMP}

As illustrated in the process flow diagram in Section C of the revised MR, the volumetric flow rate, temperature and pressure of the LFG are continuously measured at the inlet and outlet of the blower.

1) Flow meters

Three flow meters with differential pressure type are installed and operated for the measurement of $LFG_{total,y}$ (FL-02), $LFG_{flare,y}$ (FL-01), and $LFG_{electricity}$ (FL-03) (**Ref. 20**). Details of these flow meters are summarized in Table 3.

Table 3 Details of flow meter

Parameter	ID	Location	Manufacturer/ Model	Accuracy		Serial No.
				PDD	Spec	
$LFG_{total,y}$	FL-02	Inlet of blower	Siemens / Sitrans P 7MF4433-1BA22-1AC6-Z	--	0.075%	N1-U013-9599904
$LFG_{flare,y}$	FL-01	Inlet of flare	Siemens / Sitrans P 7MF4433-1BA22-1AC6-Z	--	0.075%	N1-T110-9491336
$LFG_{electricity,y}$	FL-03	Inlet of gas cooler	Siemens / Sitrans P 7MF4433-1BA22-1AC6-Z	--	0.075%	N1-U013-9599905

2) Methane analyzer

A methane analyzer (Non-dispersive Infra-red (NDIR) type) is installed at the inlet of gas engine generator and operated for the continuous monitoring of $w_{CH_4,y}$. Details of the methane analyzer are summarized in Table 4 (**Ref. 21**).

Table 4 Details of methane analyzer

Parameter	ID	Location	Manufacturer/ Model	Accuracy		Serial No.
				PDD	Spec	
$W_{CH_4,y}$ $f_{V_{CH_4,h}}$	GA-02	Inlet of gas engine generator	HITECH INSTRUMENTS Ltd. HITOX IR-600	--	± 2%	I-02253

3) Thermocouple

The temperature of the LFG is continuously measured by thermocouples at two points of inlet / outlet of the blower and logged on minutely basis by Data Acquisition System. Details of the thermocouple are summarized in Table 5 (Ref. 22).

Table 5 Details of thermocouple

Parameter	ID	Location	Manufacturer/ Model	Accuracy		Serial No.
				PDD	Spec	
T	TE-01 TE-03	Inlet of gas cooler/ blower	SHIMAX with FW System Pt100N MAC3D-MCF-NN-NTN with FWP-7A-4.8x30 (S4)	-	± 0.3 %	T07216/PT07081 T08151/PT08133

4) Pressure transmitter

The pressure of the LFG is continuously measured by pressure transmitter at two points of inlet / outlet of the blower and logged on minutely basis by Data Acquisition System. Details of the pressure transmitter are summarized in Table 6 (Ref. 23).

Table 6 Details of pressure transmitter

Parameter	ID	Location	Manufacturer/ Model	Accuracy		Serial No.
				PDD	Spec	
P	PR-01 PR-03	Inlet of gas cooler/ blower	NAGANO ADZ-SML-10.0-I	-	± 0.5%	1107030328 07202080001

5) Electricity meter

The exported and imported electricity is continuously measured by a bi-directional electricity meter. The meter is installed by MEA grid company and located at the exit of the project boundary. The meter is managed under the control of the grid company and replaced annually by new one calibrated beforehand which is the same type and accuracy as before. Details of the electricity meter is summarized in Table 7 (Ref. 24).

Table 7 Details of electricity meter

Parameter	ID	Location	Manufacturer/ Model	Accuracy		Serial No.
				PDD	Spec	
$EL_{EX,LFG}$ EL_{IMP}	--	Outlet of gas engine generator (MEA ID No: PK-201103)	ELSTER / A1RL+	-	0.2 %	MEA:2009- 9010176 MEA:2010- 046477 MEA:2011- 9044011 MEA:2012- 9044562

Through the review of the relevant documents, on-site inspection and the interview with the PPs, it is confirmed that all the monitoring equipment is appropriately installed and managed in accordance with the approved revised monitoring plan.

3.3.3 Management system and QA/QC

JS is certified for ISO 9001: 2008 with certificate No. 27667/A/0001/UK/En in a scope of “Renewable Energy Power Plant” (**Ref. 25**). JS has formed an operational and management team to monitor the emission reductions achieved by the Project activity. The data collection system and information flow, roles and responsibilities of personnel for monitoring are shown in Figure 2 (**Ref. 26**).

The operational and management team consists of JS Director, Operation manager and Operators. The role and responsibility of each staff are as follows:

JS Director

- Supervision of overall operation and maintenance;

Operation manager

- Management of overall operation and the maintenance of the project plant and monitoring equipment;
- Review of the monitoring data on a monthly basis;

Operator

- Operation of the plant;
- Reading and recording of raw monitoring data from monitoring equipment;
- Collection of electricity data and operation record of the plant;

The PPs manage the CDM monitoring activities and prepare the MR and ER calculation spreadsheet under the advice of CDM Advisor.

As for the emergency procedures, JQA confirms through the interview with the PPs that the CDM Project will not claim CERs in case where monitoring equipment malfunctions or is shut down.

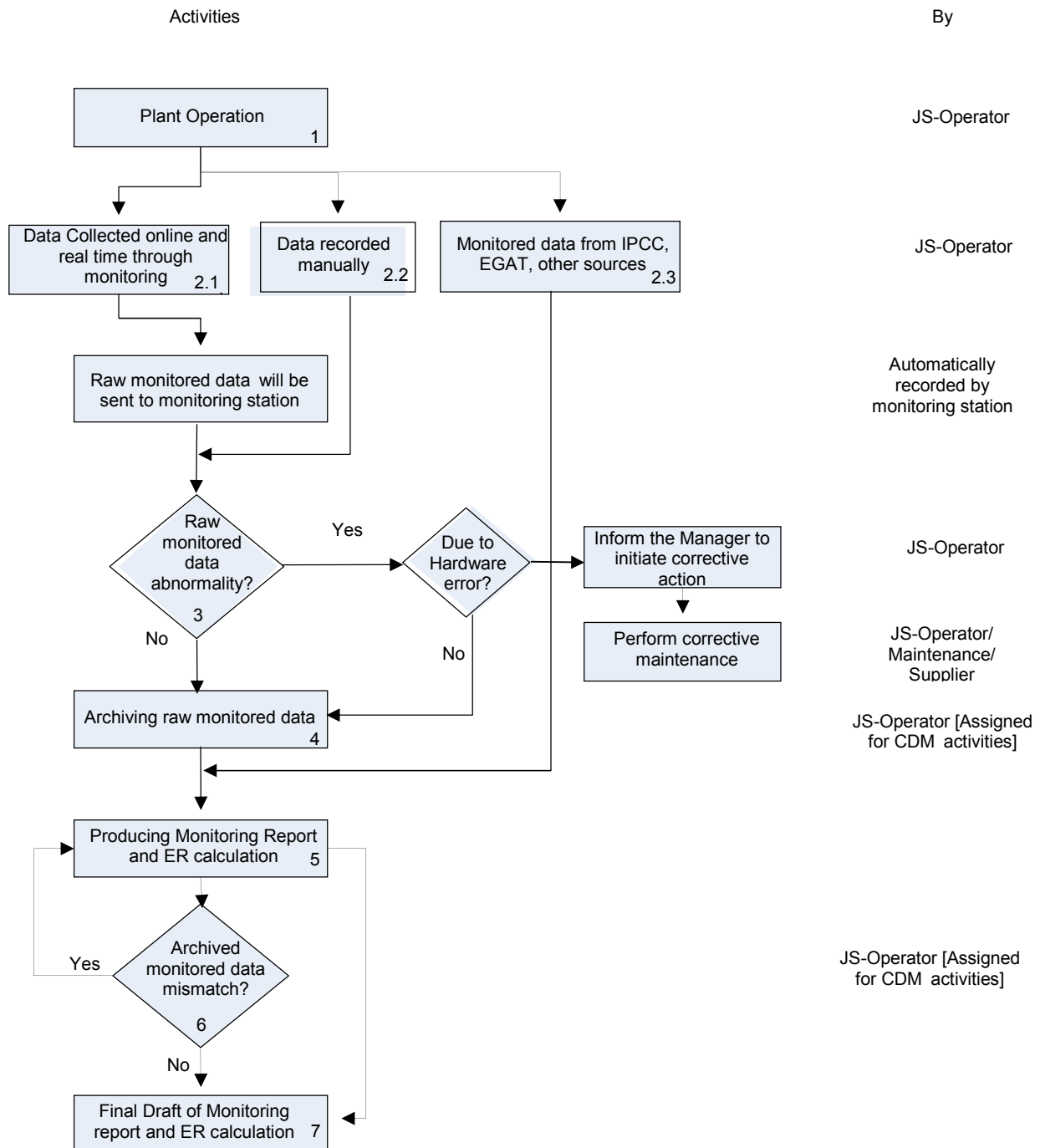


Figure 2 Monitoring work flow

The training of the CDM staffs was conducted every two months for the operation of the gas engine generator, the measurement of the LFG composition, data recording, etc. (Ref. 27). Through the review of the minutes and materials used in the training and the interview with the PPs, JQA confirms that the training is appropriately conducted during the 2nd monitoring period.

Regarding the data collection and emergency procedures, CL 04 was raised and resolved as follows:

CL 04: The relevant information on the data collection procedures (e.g. data reading and recording frequency, and date/time of reading for monthly reporting, etc.) and emergency procedures which is requested by Para. 196 of the PS is not clearly described in Section C of the MR.

Resolution: It is confirmed that the relevant information on the data collection procedures and emergency procedures are added in Section C of the revised MR.

Through the review of the relevant documents including Plant Operation Manual (**Ref. 26**), the on-site assessment and the interview with the PPs, JQA confirms that the monitoring organization and role / responsibility of each staff are appropriately established in accordance with the approved revised PDD.

3.4 Compliance with the calibration frequency requirements for measuring instruments

The information on the calibration of measuring instruments used in the monitoring activity is summarized in Table 8 (**Refs. 28-33**). The calibration of each measuring instrument was conducted by the following certified calibration entities accredited by Thai Industrial Standards Institute, Ministry of Industry (TISI): Industrial Instrument Calibration Center, Isocal Technology Co., Ltd. (**Ref. 34**); Calibration Lab., Rockertek (Thailand) Co., Ltd. (**Ref. 35**); Quality Calibration Co., Ltd. (**Ref. 36**). The electricity meter is calibrated by Meter Testing Section, Meter Division, Distribution Equipment Department of Metropolitan Electricity Authority (MEA) which is a grid company.

Through the review of the calibration certificates (**Refs. 28-33**) and the interview with the PPs, JQA checked the calibration date, validity period, calibration frequency and calibration entities of each measuring instrument. The information is summarized in Table 8. The calibration frequency of flow meter, methane analyzer, thermocouple with temperature controller and pressure transmitter are determined according to their manufacturer's recommendation and the calibration of electricity meter is conducted as per the calibration standard IEC 62053-22 (**Ref. 37**). No delayed calibration was identified for all the monitoring equipment.

Methane analyzer is calibrated annually using a standard verified gas (CH₄: 50%) and zero check is also conducted while the gas engine generator is shut down every two weeks due to the regular maintenance.

Table 8 Calibration records of measuring equipment and calibration entities

Parameter	ID	Calibration Certificate	Calibration date	Validity	Calibration frequency	Calibration entity
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LFG _{total,y}	FL-02	P08/0238C P09/0352C P10/0257C P11/0582C P12/0695C	02/08/2008 26/07/2009 18/07/2010 16/07/2011 26/06/2012	01/08/2009 25/07/2010 17/07/2011 15/07/2012 25/06/2013	Once a year	Isocal Technology Co., Ltd. -- Industrial Instrument Calibration Center <Accred. No.: CALIB 0085> Validity:16/09/2009 - 15/09/2012 Date of initial issue: 08/02/2006
LFG _{flarey} FV _{RG, h}	FL-01	PKT-0809045 P09/0350C P10/0256C P11/0581C P12/0694C	18/09/2008 13/09/2009 11/09/2010 04/09/2011 02/09/2012	17/09/2009 12/09/2010 10/09/2011 03/09/2012 01/09/2013		(2008) - Rockertek (Thailand) Co., Ltd. - Calibration Lab. <Accred.: CALIB 0069> Validity:30/01/2011 - 29/01/2014 Date of initial issue: 31/01/2008
LFG _{electricit y,y}	FL-03	PKT-0809044 P09/0351C P10/0258C P11/0583C P12/0696C	18/09/2008 13/09/2009 11/09/2010 04/09/2011 02/09/2012	17/09/2009 12/09/2010 10/09/2011 03/09/2012 01/09/2013		(2009-2012) Isocal Technology Co., Ltd. - Industrial Instrument Calibration Center
fV _{CH4,h} W _{CH4,y}	GA-02	E080003 E100001 G101897 G111145 G123539	04/12/2008 29/11/2009 07/11/2010 05/10/2011 09/09/2012	03/12/2009 28/11/2010 06/11/2011 04/10/2012 08/09/2013	Once a year	Energy Solution Provider Co., Ltd. Outsourced to Quality Calibration Co., Ltd. <Accred. No.: CALIB 0049> Validity: 13/07/2013 - 12/07/2015 Date of initial issue: 17/07/2003
T	TE-01	T08/0674C T09/0855C T10/0816C T11/1113C T12/1471C	30/12/2008 20/12/2009 18/12/2010 17/12/2011 16/12/2012	29/12/2009 19/12/2010 17/12/2011 16/12/2012 15/12/2013	Once a year	Isocal Technology Co., Ltd. -Industrial Instrument Calibration Center
	TE-03	T-0807154 T09/0326C T10/0434C T11/0528C T12/0810C	22/07/2008 19/07/2009 18/07/2010 09/07/2011 08/07/2012	21/07/2009 18/07/2010 17/07/2011 08/07/2012 07/07/2013		
P	PR-01	P08/0550C P09/0525C P10/0385C P11/0663C P12/0750C	30/12/2008 20/12/2009 18/12/2010 17/12/2011 16/12/2012	29/12/2009 19/12/2010 17/12/2011 16/12/2012 15/12/2013	Once a year	Isocal Technology Co.,Ltd. -- Industrial Instrument Calibration Center

	PR-03	CAL0069-08Q0073 P09/0197C P10/0201C P11/0364C P12/0529C	14/08/2008 01/08/2009 18/07/2010 09/07/2011 08/07/2012	13/08/2009 31/07/2010 17/07/2011 08/07/2012 07/07/2013		- (2008) - Rockertek (Thailand) Co., Ltd. - Calibration Lab. - (2009-2012) Isocal Technology Co., Ltd. -Industrial Instrument Calibration Center
EL _{EX,LFG} EL _{IMP}	Electricity meter	N/A MT Lab. 16/2552 MT Lab. 07/2553 MT Lab. 11/2554 MT Lab. 12/2555	12/06/2008 10/06/2009 28/04/2010 27/04/2011 25/04/2012	11/06/2009 09/06/2010 27/04/2011 26/04/2012 24/04/2013	Once a year	Meter Testing Section, Meter Division, Distribution Equipment Department of MEA

Regarding the calibration date, CAR 02 was raised and resolved as follows:

CAR 02: The calibration data of monitoring equipment such as flow meter, CH₄ analyzer, electricity meter, thermocouple and pressure transmitter in Section D.2 of the MR are not consistent with their calibration certificates.

Resolution: It is confirmed that the calibration dates of monitoring equipment listed in Section D.2 are appropriately corrected in the revised MR and are consistent with those in their calibration certificates.

Through the review of the calibration certificates and the interview with the PPs, JQA confirms that all the monitoring equipment has been appropriately calibrated annually without delay in accordance with the manufacturer's recommendation.

3.5 Assessment of data and calculation of GHG emission reductions

Through the desk review and the on-site assessment, JQA confirms that a complete set of data covering the whole monitoring period and relevant documents were provided to JQA by the PPs.

3.5.1 Assessment of data

1) Recording and aggregation of monitoring data

JQA confirms that the following five data recording sheets are used by the PPs:

- Minutely monitoring data sheet (raw data) downloaded from the data logger (**Ref.38**),
- Hourly data sheet aggregated from the minutely monitoring data (**Ref. 39**),
- Monthly data sheet aggregated from the hourly data (**Ref. 40**),
- Operation logbook of gas engine generator (**Ref. 41**),
- Record of electricity export and import measured by the EMA grid meter (**Ref. 42**).

Data of volumetric flow rate, CH₄ concentration, temperature and pressure of the LFG

are logged minutely by the Data Acquisition System and stored in the data logger. The minutely data (raw data) are downloaded from the data logger every two weeks while the plant is shut down due to the regular maintenance. Then, Hourly data and Monthly data are prepared by the aggregation of the Minutely data.

The operation of the gas engine generator is monitored by the operator and the quantity of the gross electricity generation is manually recorded every half hour for operation management and cross-checking with the electricity export data measured by the MEA electricity meter.

Data of electricity export and import measured with the MEA electricity meter located at the exit of the project site are read and recorded by the MEA grid staff and JS staff together at the end of every month. Then, the MEA grid company issued the purchase invoice for electricity export to the grid every month and the sales record for electricity import from the grid during the 2nd monitoring period.

2) Materiality and sampling plan

As mentioned in Section 2.3 of this report, JQA has conducted a verification using the concept of materiality in order to detect errors, omissions or misstatement in emission reductions claimed by the PPs in the MR (ver. 1.0) and the ER calculation spreadsheet. The materiality threshold, risk assessment and designed verification/ sampling plan for the 2nd periodic verification are summarized below.

(1) Materiality threshold

Since the CDM Project is a large scale project activity achieving an annual average emission reductions of 30,208 tCO₂e (= 120,833 tCO₂e/4 yr) during the 2nd monitoring period, a 2 % materiality threshold can be applied to achieve reasonable level assurance as per Para 10 of “Guideline on the application of materiality in verifications” (ver. 01.0). The 2 % materiality threshold is equivalent to 2,416 tCO₂e (=120,833 tCO₂e x 0.02) for this monitoring period.

(2) Risk assessment and designed verification/sampling plan

According to the methodology ACM0001 (ver. 05), the GHG emission reductions are estimated as follows:

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times GWP_{CH4} + EL_y \times CEF_{electricity,y} - ET_y \times CEF_{thermal,y}$$

$$MD_{project,y} = MD_{flare,y} + MD_{electricity,y} + MD_{thermal,y}$$

In the CDM Project, most of the LFG is utilized for electricity generation and therefore the flare efficiency is measured to be zero during the 2nd monitoring period. Accordingly, MD_{flare} is determined as zero in the project activity. As the LFG is not used for thermal energy generation, MD_{thermal,y} is also determined as zero. Furthermore, there is no captive power plant or other type of plant which consumes fossil fuel within the project boundary, ET_y is determined as zero. As there is no regulation for LFG collection/combustion in Thailand, MD_{reg,y} = 0. As a result, the emission reductions achieved by the project activity are calculated from only two parameters, i.e., MD_{electricity,y} (quantity of methane destroyed by generation of electricity) and EL_y (net quantity of electricity exported to the grid).

From an initial review of data provided by the PPs, the first emission source (M_{Electricity,y}) accounts for 91.1% ($= 110,124 \text{ tCO}_2\text{e}/120,833 \text{ tCO}_2\text{e} \times 100$) of the total emission reductions and the second source (E_{L,y}) accounts for 8.7% ($= 10,458 \text{ tCO}_2\text{e}/120,833 \text{ tCO}_2\text{e} \times 100$).

The data of volumetric flow rate (at STP) and methane concentration of the LFG used in the calculation of M_{Electricity,y} are directly logged by Data Acquisition System on minutely basis and downloaded to the Excel calculation spreadsheet in a form of hourly data. Therefore, the first source accounting for 91.3% of the total emission reductions has the low risk for errors, omissions or misstatements because the data are automatically recorded in a spreadsheet. However, due to the huge size of hourly data, the occurrence of errors would be anticipated in the aggregation from the hourly data to the monthly data.

E_{L,y} is calculated from the monthly data of electricity export and import which are recorded manually by the grid company's staff and JS staff together, and then cross-checked with sales/ purchase invoices (**Refs. 43, 44**). The second source accounting for 8.7% of the total emission reductions has relatively higher potential for errors, omissions or misstatements caused by the human error, in despite of less number of the electricity data.

The verification plan is therefore designed to ensure that the majority of time to test and detect potential errors is spent on verifying the data of M_{Electricity,y} and E_{L,y} which have potential to impact directly on the determination of the emission reductions.

Table 9 summarizes the potential risks of errors, omissions and misstatements in the relevant data recording documents, the ER calculation spreadsheet and the MR for the following types of risks:

- Inherent risk: risk associated with the complexity of the project and tasks being performed;
- Control risk: risk that the controls of the GHG project will not prevent or detect a material discrepancy;
- Detection risk: risk that the verifier will not detect any material discrepancy that has not been corrected by the controls of the GHG project.

The impact of each risk is evaluated as follows:

- The inherent risk for parameters measured by continuous monitoring equipment and electronically recorded in Data Acquisition System is considered low, while the electricity data which is continuously monitored and manually recorded are considered to have relatively high inherent risk.
- The PPs have been operating the CDM monitoring system for more than 4 years and experienced periodic verification once. Therefore, the internal control system is considered to be effective and control risk is generally low.
- From above analysis, the sampling plan described in Table 10 is made to ensure that detection risk is appropriately controlled.

As noted in Table 9, JQA decided to verify the hourly data of volumetric flow rate, methane concentration, temperature and pressure of the LFG for electricity generation through cross-checking with the minutely data (raw data) of 540 samples downloaded

from the data logger by random sampling. In addition, the monthly electricity export/import data measured with the grid meter is planned to be cross-checking with the sales/purchase invoices provided by the grid company. This verification plan surely contributes to improve accuracy and reliability of reported values in the MR and the ER calculation spreadsheet.

(3) Detected errors, omissions and misstatements and corresponding revision of verification/sampling plan

Following errors, omissions and misstatements are identified by the initial review of the ER calculation spreadsheet:

- Hourly data of parameters (volumetric flow rate, methane concentration, temperature and pressure of LFG) were cross-checked with their minutely data (raw data) of 540 samples downloaded from the data logger during the on-site assessment, but no errors were detected in the sample. Thus, JQA concludes that there is no risk of material errors in the hourly data set and further sampling is not needed.
- In the aggregation of volumetric flow rate data of the LFG from hourly data to monthly data, the systematic miscalculation was detected in the data set in April and Nov of 2009-2012 due to the inappropriate equation in the ER calculation spreadsheet. Thus, CAR 04-3) was raised.
- As a result of cross-checking the total 48 monthly electricity export/ import data recorded by the grid electricity meter with the purchase invoices /sales record issued by the grid company, the isolated omission were detected in the monthly export/ import electricity data in Feb and Dec of 2009. Thus, CAR 04-1) and CAR 04-2) were raised.
- These errors, omissions and miscalculation gave increased emission reductions by about 5,430 tCO₂e, which is beyond the threshold of 2%. As these errors caused a material impact on the initial reported emission reductions of 120,833 tCO₂e, the PPs were immediately requested to correct the calculation in the ER calculation spreadsheet and the MR.

In response to CAR 04 issued by JQA, the revised ER calculation spreadsheet and the revised MR were provided by the PPs. As a result of the second review of the revised ER calculation spreadsheet and the revised MR, JQA has confirmed that the emission reductions in these documents are correctly and transparently calculated and there are no more errors, omissions and misstatements.

Regarding the calculation of the emission reductions in the ER calculation spreadsheet, CAR 03, CAR 04 and CAR 05 were raised and resolved as follows:

CAR 03: Hourly data of flaring is not included in the ER calculation spreadsheet, in accordance with the tool "Tool to determine project emissions from flaring gases containing methane" (EB26, Annex 13).

Resolution: It is confirmed that hourly data of flaring is appropriately added in the revised ER calculation spreadsheet to meet the requirement in the "Flare tool".

CAR 04: 1) The amount of exported electricity in Dec 2009 in the ER calculation spreadsheet is not consistent with that of sale invoice.

2) The amount of imported electricity in Feb 2010 in the MR and ER calculation spreadsheet is not consistent with that of electricity import records from the grid.

3) The aggregation of volumetric flow rate data of the LFG from hourly data to monthly data in Apr and Nov of 2009-2012 is not correctly calculated due to the inappropriate equation in the ER calculation spreadsheet.

Resolution: Following corrections are confirmed in the revised ER calculation spreadsheet.

1) The electricity export of 106 MWh is correctly added.

2) The electricity import of 1 MWh is correctly added.

3) The volumetric flow rate data of the LFG in Apr and Nov of 2009-2012 are correctly calculated in the aggregation of monthly data from the hourly data.

CAR 05: Following calculations are not correct in the MR and ER calculation spreadsheet:

1) The unit of methane density is not correct in the calculation of $TM_{RG,h}$ and $PE_{flare,y}$.

2) The values of $w_{CH_4,y}$ are not correct in the calculation of MD_{flare} .

Resolution: 1) It is confirmed that $TM_{RG,h}$ and $PE_{flare,y}$ are correctly calculated in the revised ER calculation spreadsheet.

2) It is confirmed that the correct value of $w_{CH_4,y}$ are used in the calculation of MD_{flare} in the revised ER calculation spreadsheet.

Table 9 Risk assessment of parameters

Parameter measured	ID	Effect on ERs	Monitoring & Reading frequency	Recording frequency	Data transfer to ER spreadsheet	Risk			Sample size	Documentation checked
						Inherent	Control	Detection		
LFG _{flare,y}	FL-01	Low	Continuously & hourly	Hourly & monthly	Electronic	Low	Low	High	High	-Minutely data - Hourly data - Monthly data
LFG _{total,y}	FL-02	Low								
LFG _{electricity,y}	FL-03	High								
f _{CH4,h} w _{CH4,y}	GA-02	High	Continuously & hourly	Hourly & monthly	Electronic	Low	Low	High	High	- Minutely data - Hourly data - Monthly data
T	TE-01 TE-03	Middle								
P	PR-01 PR-03	Middle								
Flare operation parameter P	Flame Detector	Low								
Flare efficiency	η_{flare}	Low	Continuously & minutely	Minutely & hourly	Electronic	Low	Low	High	High	- Minute data - Hourly data
EL _{EX,LFG} EL _{IMP}	Electricity meter	High	Continuously & hourly	Monthly & yearly	Manual	Low	Middle	Low	Low	- Logbook - Invoices
Operation of energy plant	--	Middle	Daily	annually	--	--	--	--	--	- Logbook
Regulatory requirements	--	--	--	annually	--	--	--	--	--	- National or local regulation

3.5.2 Calculation of GHG emission reductions

1) Assumptions, default values and factors

The following six default value and factors, which are not monitored and determined *ex-ante*, are described in D.1 of the revised MR:

- GWP_{CH_4} : Global warming potential of methane from IPCC; 21 tCO_2e / tCH_4
- D_{CH_4} : Methane density at standard temperature and pressure (0°C and 1.013 bar) from ACM 0001; 0.0007168 tCH_4/m^3CH_4
- AF : Adjustment factor; As there are currently no regulatory requirements for LFG collection / utilization in Thailand, the value of AF is 0%.
- EF_{grid} ($CEF_{electricity,y}$) : CO_2 emission factor of the grid; 0.51 tCO_2/MWh which was determined *ex-ante* at the validation.
- EF_{OM} : CO_2 operating margin emission factor of the grid; 0.60 tCO_2/MWh
- EF_{BM} : CO_2 build margin emission factor of the grid; 0.42 tCO_2/MWh

JQA confirms that above default values and factors are correctly applied in the calculation of emission reductions.

Regarding the source of CH_4 density and description on parameters in D.2, CL 05 and CL 06 were raised and resolved as follows:

CL 05: The source of CH_4 density is not clearly described in the MR.

Resolution: It is confirmed that the parameter of CH_4 density is added in Section D.1 of the revised MR.

CL 06 : Followings are not appropriately provided in the MR:

- 1) "Project emissions" in "Purpose of data" for $LFG_{flare,y}$, $LFG_{electricity,y}$ and $w_{CH_4,y}$ is not relevant.
- 2) Data in "Flare operation parameter" is not included.
- 3) Regarding T and P, calibration frequency "Once a year" and QA/QC procedures "Maintenance free. Only replacement" are contradictory.
- 4) Accuracy class and calibration frequency of electricity meter are not clearly described.

Resolution: Followings are confirmed in the revised MR.

- 1) "Project emissions" are correctly removed from "Purpose of data" in $LFG_{flare,y}$, $LFG_{electricity,y}$ and $w_{CH_4,y}$.
- 2) "Values of monitored parameter" in "Flare operation parameter" is correctly revised from N/A to zero.
- 3) The description of QA/QC procedures for parameters T and P is appropriately revised, based on the actual implementation of calibration.
- 4) Accuracy (0.2%) and calibration frequency (annually) of electricity meter are added in the revised MR, based on the catalogue and calibration certificates.

2) Emission reductions

According to the methodology ACM0001 (ver. 05), the GHG emission reductions achieved by the project activity during a given year “y” (ER_y) are estimated by Eq. (1):

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times GWP_{CH_4} + EL_y \times CEF_{electricity,y} - ET_y \times CEF_{thermal,y}$$

..... Eq. (1)

Where:

- ER_y : Emission reductions in tonnes of CO₂ equivalents (tCO₂e)
MD_{project,y} : Amount of methane that would have been destroyed/combusted during the year in tonnes of methane (tCH₄)
GWP_{CH₄} : Global Warming Potential value for methane for the first commitment period is 21 tCO₂e/tCH₄
EL_y : Net quantity of electricity exported during year y in megawatt hours (MWh)
CEF_{electricity,y} : CO₂ emissions intensity of the electricity displaced in tCO₂e/MWh
ET_y : Incremental quantity of fossil fuel defined as difference of fossil fuel used in the baseline and fossil fuel used during the project for energy requirement on-site under project activity during the year in TJ
CEF_{thermal,y} : CO₂ emissions intensity of the fuel used to generate thermal/mechanical energy in tCO₂e/TJ

Based on the actual project activity during the 2nd monitoring period, each parameter in Eq. (1) is reviewed as follows:

(1) Amount of methane destroyed during the project (MD_{project,y})

MD_{project,y} is determined *ex-post* by metering the actual quantity of methane captured and destroyed, i.e., by monitoring the quantity of methane actually flared and gas used to generate electricity and/or produce thermal energy, if applicable, and the total quantity of methane captured. Namely, MD_{project,y} is calculated by Eq. (2):

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y}$$

..... Eq. (2)

Where:

- MD_{flared,y} : Quantity of methane destroyed by flaring during year y (tCH₄/year)
MD_{electricity,y} : Quantity of methane destroyed by generation of electricity during year y (tCH₄/year)
MD_{thermal,y} : Quantity of methane destroyed by generation of thermal energy during year y (tCH₄/year)

According to the methodology, the sum of the quantities fed to the flare, to the power plant and to the boiler must be compared annually with the total generated, and it must be confirmed that the total generated is higher than the sum of the quantities fed to the flare, to the power plant and to the boiler. And, the lowest value of MD_{project,y} must be adopted for conservativeness.

In addition, the working hours of the energy plant and the boiler should be monitored and no emission reductions could be claimed for methane destruction during non-operational hours of the energy plant or the boiler.

Regarding the calculation of PE_{flare,y}, CL 09 was raised and solved as follows:

CL 09: The calculation procedures for $PE_{flare,y}$ in the hourly data of ER calculation spreadsheet are not clear in the following points:

- 1) How the total hour of flare operation is determined.
- 2) How $PE_{flare,y}$ is calculated in the hourly data sheet.
- 3) Data of temperature and pressure at two monitoring points are not appropriately included in Hourly and Monthly data sheets, whereas these data are included in Minutes data sheets.

Resolution: Following are confirmed in the calculation procedure of $PE_{flare,y}$.

- 1) The column of “Flare operating hour” is newly added and counted appropriately in the revised ER calculation spreadsheet.
- 2) The column of “ PE_{flare} ” is newly added and calculated appropriately in the revised ER calculation spreadsheet.
- 3) The temperature and pressure data of the LFG at the inlet of the blower are added appropriately in the revised ER calculation spreadsheet.

Determination of $MD_{flared,y}$

The quantity of methane destroyed by flaring, $MD_{flared,y}$, is estimated by Eq. (3):

$$MD_{flared,y} = (LFG_{flare,y} \times W_{CH_4,y} \times D_{CH_4}) - (PE_{flare,y} / GWP_{CH_4}) \quad \dots\dots \text{Eq. (3)}$$

Where:

- $LFG_{flare,y}$: Quantity of landfill gas fed to the flare during the year measured in cubic meters (m^3 /year)
- $W_{CH_4,y}$: Average methane fraction of the landfill gas as measured during the year and expressed as a fraction (m^3CH_4/m^3LFG)
- D_{CH_4} : Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)
- $PE_{flare,y}$: Project emissions from flaring of the residual gas stream in year y (tCO_2 /year), calculated as per the “Tool to determine project emissions from flaring gases containing methane”

As per the “Tool to determine project emissions from flaring gases containing methane”, $PE_{flare,y}$ is calculated by Eqs. (3a) and (3b):

$$PE_{flare,y} = \sum_{h=1}^{8760} TM_{RG,h} \times (1 - \eta_{flare,h}) \times \frac{GWP_{CH_4}}{1000} \quad \dots\dots\dots \text{Eq. (3a)}$$

$$TM_{RG,h} = FV_{RG,h} \times fv_{CH_4,RG,h} \times \rho_{CH_4,n} \quad \dots\dots\dots \text{Eq. (3b)}$$

Where:

- $TM_{RG,h}$: Mass flow rate of methane in the residual gas in the hour h (kg/h)
- $\eta_{flare,h}$: Flare efficiency in hour h
- $FV_{RG,h}$: Volumetric flow rate of the residual gas in dry basis at normal conditions in hour h (m^3 /h)
- $fv_{CH_4,RG,h}$: Volumetric fraction of methane in the residual gas on dry basis in hour h
- $\rho_{CH_4,n}$: Density of methane at normal conditions (0.716 kg/Nm^3)

In the CDM Project, the flame in the flare is minutely detected by a flame detector. As the open flare is used in the project, the flare efficiency in the hour h ($\eta_{\text{flare},h}$) is

- 0 % if the flame is not detected for more than 20 minutes during the hour h .
- 50 % if the flame is detected for more than 20 minutes during the hour h .

As mentioned in Section 3.1.2 of this report, most of the LFG was sent to the gas engine generator and therefore the open flare system was rarely operated. Indeed, the flare efficiency was 0 % throughout the 2nd monitoring period due to the shortage of the LFG which was fed to the open flare. Namely, the result means that none of the LFG fed to the open flare was destroyed and therefore the calculated value of $MD_{\text{flared},y}$ expressed by Eq. (3) is zero. In fact, the PPs do not claim the CER for the emissions from the flaring of the LFG during the 2nd monitoring period. As a result,

$$MD_{\text{flare},y} = 0$$

Determination of $MD_{\text{electricity},y}$

In the CDM Project, most of the LFG collected is utilized for the generation of electricity by gas engine generator. The quantity of methane destroyed by generation of electricity, $MD_{\text{electricity},y}$, is estimated by Eq. (4):

$$MD_{\text{electricity},y} = LFG_{\text{electricity},y} \times w_{\text{CH}_4,y} \times D_{\text{CH}_4} \quad \dots\dots\dots \text{Eq. (4)}$$

Where:

$LFG_{\text{electricity},y}$: Quantity of landfill gas into electricity generator during the year y (m^3/year)

According to the methodology, $w_{\text{CH}_4,y}$ is expressed as the average methane fraction of the LFG measured during the year. In the CDM Project, $MD_{\text{electricity},y}$ is calculated on a hourly basis and summed up to monthly data.

Determination of $MD_{\text{thermal},y}$

In the CDM Project, the LFG collected is utilized only for the generation of electricity by gas engine generator and there is no use of the LFG for the boiler (i.e., generation of thermal energy) on-site. Therefore,

$$MD_{\text{thermal},y} = 0$$

In conclusion, $MD_{\text{project},y}$ expressed by Eq. (2) is reduced to as follows:

$$\begin{aligned} MD_{\text{project},y} &= MD_{\text{flared},y} + MD_{\text{electricity},y} + MD_{\text{thermal},y} \\ &= 0 + MD_{\text{electricity},y} + 0 \\ &= MD_{\text{electricity},y} \end{aligned}$$

(2) Amount of methane destroyed in the absence of the project ($MD_{\text{reg},y}$)

In the case where the $MD_{\text{reg},y}$ is given/defined as a quantity, the quantity is estimated by Eq. (5):

$$MD_{\text{reg},y} = MD_{\text{project},y} \times AF \quad \dots\dots \text{Eq. (5)}$$

Where:

AF : Adjustment Factor, 0%

In case where regulatory or contractual requirements do not specify $MD_{reg,y}$, an AF shall be used and justified, taking into account the project context. For the CDM Project, the AF is set as 0% because there are no enforced regulatory or contractual requirements for LFG collection/ utilization in Thailand. Thus,

$$MD_{reg,y} = 0$$

(3) Net Quantity of electricity export (EL_y)

Net quantity of electricity export to the grid by the project activity is determined by Eq. (6):

$$EL_y = EL_{EX, LFG} - EL_{IMP} \quad \dots\dots\dots \text{Eq. (6)}$$

Where:

$EL_{EX, LFG}$: Total amount of electricity exported out of the project boundary, MWh.

EL_{IMP} : Total amount of electricity imported to meet project requirement, MWh.

Regarding the font used in the ER calculation spreadsheet, CL 10 was raised and solved as follows:

CL 10: Different font other than English is included in the “Electricity generation” sheet of the ER calculation spreadsheet.

Resolution: It is confirmed that Thai alphabets left in the ER calculation spreadsheet is removed in the revised one.

(4) Incremental quantity of fossil fuel (ET_y)

Any fossil fuel for energy requirement on-site is not used in the baseline and in the project activity. Therefore, there is no incremental quantity of fossil fuel in the project activity. Thus,

$$ET_y = 0$$

In conclusion, the GHG emission reductions (ER_y) for the CDM Project during the 2nd monitoring period are reduced to as follows:

$$\begin{aligned} ER_y &= (MD_{project,y} - MD_{reg,y}) \times GWP_{CH4} + EL_y \times CEF_{electricity,y} - ET_y \times CEF_{thermal,y} \\ &= (MD_{project,y} - 0) \times GWP_{CH4} + (EL_y \times CEF_{electricity,y}) - 0 \\ &= (MD_{project,y} \times GWP_{CH4}) + (EL_y \times CEF_{electricity,y}) \\ &= (MD_{electricity,y} \times GWP_{CH4}) + (EL_y \times CEF_{electricity,y}) \\ &= (LFG_{electricity,y} \times w_{CH4,y} \times D_{CH4} \times GWP_{CH4}) + (EL_y \times CEF_{electricity,y}) \dots\dots \text{Eq. (7)} \end{aligned}$$

Determination of emission reductions (ER_y)

As described above, the GHG emission reductions achieved by the project activity during the 2nd monitoring period are determined by Eq. (7). The calculation of ER_y is summarized in Table 10.

Table 10 Monthly data and determination of emission reductions (ER_y)

Period	LFG _{total,y} (Nm ³)	LFG _{electricity,y} (Nm ³)	LFG _{flare,y} (Nm ³)	w _{CH4} * (%)	EL _{EX, LFGR} (MWh)	EL _{IMP} (MWh)	ER _y (tCO ₂ e)
Jan 2009	397,158	384,514	2,004	46.6	534	0	
Feb 2009	354,581	340,745	1,737	50.9	564	0	
Mar 2009	424,370	398,313	1,649	51.8	688	0	
Apr 2009	405,370	396,634	1,736	52.6	685	0	
May 2009	401,365	401,248	1,121	51.1	703	0	
Jun 2009	405,444	401,680	793	47.4	680	0	
Jul 2009	388,983	374,945	818	47.8	666	0	
Aug 2009	241,158	234,645	901	47.5	398	0	
Sep 2009	401,637	389,196	970	46.9	656	0	
Oct 2009	324,309	314,005	980	47.7	533	0	
Nov 2009	303,306	288,667	2,038	48.5	558	0	
Dec 2009	409,594	397,908	2,047	43.8	684	0	
Sub total	4,457,275	4,322,500	16,794	48.5	7,349	0	35,247
Jan 2010	413,308	399,520	1,263	48.8	569	0	
Feb 2010	365,486	354,148	805	48.2	502	1	
Mar 2010	401,129	394,647	2,060	49.1	594	0	
Apr 2010	291,826	285,476	1,197	50.3	440	0	
May 2010	326,023	314,387	1,108	47.7	484	0	
Jun 2010	294,205	287,858	2,172	41.3	272	0	
Jul 2010	366,340	365,808	1,986	45.1	489	0	
Aug 2010	366,367	363,645	401	38.0	320	0	
Sep 2010	262,186	253,560	1,445	38.7	239	0	
Oct 2010	354,474	352,449	1,453	35.2	336	0	
Nov 2010	372,929	374,152	2,695	40.8	470	0	
Dec 2010	373,969	375,830	2,346	42.1	460	0	
Sub total	4,188,242	4,121,480	18,931	43.8	5,175	1	29,665
Jan 2011	417,691	419,176	1,222	39.3	436	0	
Feb 2011	359,843	359,330	1,260	46.9	445	0	
Mar 2011	354,084	349,201	1,687	49.3	331	0	
Apr 2011	0	0	0	-	0	0	
May 2011	392,673	368,166	0	46.4	523	0	
Jun 2011	352,566	330,891	1	46.3	354	0	
Jul 2011	462,842	430,657	1	43.8	478	0	
Aug 2011	436,876	406,290	0	40.3	416	0	
Sep 2011	446,844	416,554	0	37.6	350	0	
Oct 2011	390,248	361,028	59	37.6	400	0	
Nov 2011	448,215	411,565	0	35.0	363	0	
Dec 2011	433,569	397,368	0	36.4	283	0	

Sub total	4,495,451	4,250,226	4,230	<u>41.7</u>	4,379	0	28,630
Jan 2012	397,374	352,436	15	40.4	486	0	
Feb 2012	426,052	378,096	0	42.4	277	0	
Mar 2012	453,134	391,095	1	43.9	350	0	
Apr 2012	435,308	368,316	7	45.5	320	0	
May 2012	430,099	360,496	7	49.2	321	0	
Jun 2012	411,850	343,330	7	53.3	323	0	
Jul 2012	454,943	381,463	4	54.8	349	0	
Aug 2012	405,038	332,666	0	52.0	294	0	
Sep 2012	423,669	353,262	0	52.5	302	0	
Oct 2012	433,270	354,950	0	50.5	290	0	
Nov 2012	389,931	315,030	0	47.5	220	0	
Dec 2012	396,063	320,613	0	45.6	223	0	
Sub total	5,056,731	4,251,753	41	<u>48.1</u>	3,755	0	32,722
Total	18,197,699	16,945,959	39,996	<u>45.5</u>	20,658	1	126,264

* The value of w_{CH_4} in the table is expressed as monthly and yearly average values, respectively.

The sum of the quantities fed to the flare and to the gas engine generator is compared annually with the total generated, in accordance with the methodology. As shown by the volumetric flow rate data of the LFG in Table 10, JQA confirms that the value of $LFG_{total,y}$ is larger than the sum of $LFG_{electricity,y}$ and $LFG_{flare,y}$ every year during the 2nd monitoring period. Although it was observed that the difference between $LFG_{total,y}$ and the sum of $LFG_{electricity,y}$ and $LFG_{flare,y}$ tended to increase since May 2011, the value of the emission reductions is not affected by the increase in the loss of the LFG because the amount of the loss is not included in the calculation process of the emission reductions.

As shown in the revised ER calculation spreadsheet (ver. 3.0), the monthly data of $LFG_{total,y}$, $LFG_{electricity,y}$, $LFG_{flare,y}$ and w_{CH_4} in Table 10 are sourced from their hourly data, and the emission reductions are originally calculated from the hourly data of $LFG_{electricity,y}$ and the monthly data of net electricity export to the grid (EL_y) by using Eq. (7).

The data of monthly electricity export to the grid and electricity import from the grid measured by the MEA electricity meter are cross-checked with the purchase invoices and sales record issued by the MEA grid company (**Refs. 43, 44**). JQA confirms that the monthly export and import data in the revised ER calculation spreadsheet are completely consistent with those in the purchase invoices and sales record. From these electricity data verified above, the net electricity supplied to the grid by the CDM Project is determined to be 20,658 MWh for the 2nd monitoring period.

JQA confirms that the emission reductions in the revised MR and the revised ER calculation spreadsheet are calculated correctly and transparently, and that the emission reductions achieved by the CDM Project during the 2nd monitoring period are determined to be 126,264 tCO₂e. The initial estimates of the emission reductions in the MR (ver. 1.0), 120,833 tCO₂e, were revised to 126,264 tCO₂e as a result of resolution of CAR 04.

4) Leakage emissions

No leakage effects need to be accounted under this methodology

3.5.3 Difference from estimated value in the PDD

The actual GHG emission reductions achieved in the 2nd monitoring period from 01/01/2009 to 31/12/2012 (4 years) are 126,264 tCO₂e, which corresponds to about 52.7 % of the estimated emission reductions of 239,704 tCO₂e in the approved revised PDD. As per the guideline for completing the monitoring report form, further explanation is not provided in the revised MR.

3.6 Post registration changes

3.6.1 Temporary deviations from the registered monitoring plan and/or monitoring methodology

As described in Chapter 3, JQA confirms that there are no temporary deviations from the approved revised monitoring plan and/or monitoring methodology during the 2nd monitoring period.

3.6.2 Corrections

JQA confirms that there are no corrections to project information or parameters in the approved revised PDD during the 2nd monitoring period.

3.6.3 Changes to the start date of the crediting period

As described in Section 3.1.1, JQA confirms that there are no changes to the start date of the crediting period during the 2nd monitoring period.

3.6.4 Permanent changes from the registered monitoring plan or monitoring methodology

As described in Section 3.2, JQA confirms that there are no permanent changes from the approved revised monitoring plan or monitoring methodology.

3.6.5 Changes to the project design of a registered project activity

As described in Section 3.1, JQA confirms that there are no changes to the project design of a registered project activity.

3.6.6 Types of changes specific to afforestation or reforestation project activity

Not applicable.

4. ISSUES RAISED DURING VERIFICATION

JQA raised five CARs and ten CLs during the 2nd verification process. The issues are listed below.

<CAR 01> The process flow diagram with monitoring parameters and points is not included in Section C of the MR.

<CAR 02> The calibration date of monitoring equipment such as flow meter, CH₄ analyzer, electricity meter, thermocouple and pressure transmitter in Section D.2 of the MR are not consistent with their calibration certificates.

<CAR 03> Hourly data of flaring is not included in the ER calculation spreadsheet, in accordance with the tool "Tool to determine project emissions from flaring gases containing methane" (EB26, Annex 13).

<CAR 04> 1) The amount of exported electricity in Dec 2009 in the ER calculation spreadsheet is not consistent with that of sale invoice.
2) The amount of imported electricity in Feb 2009 in the MR and ER calculation spreadsheet is not consistent with that of electricity import records from the grid.
3) The aggregation of volumetric flow rate data of the LFG from hourly data to monthly data in Apr and Nov of 2009-2012 is not correctly calculated due to the inappropriate equation in the ER calculation spreadsheet.

<CAR 05> Following calculations are not correct in the MR and ER calculation spreadsheet:

- 1) The unit of methane density is not correct in the calculation of $TM_{RG,h}$ and $PE_{flare,y}$.
- 2) The values of $w_{CH_4,y}$ are not correct in the calculation of MD_{flare} .

<CL 01> Commissioning date of the project plant is not included in Section A.1 of the MR.

<CL 02> The implementation status of the project activity such as events or situations that occurred during this monitoring period is not detailed in Section B.1 of the MR.

<CL 03> The relevant information on the installed technology(ies), technical process and main specification of equipment is not included in Section B.1 of the MR.

<CL 04> The relevant information on the data collection procedures (e.g. data reading and recording frequency, and date/time of reading for monthly reporting, etc.) and emergency procedures which is requested by Para. 196 of the PS is not clearly described in Section C of the MR.

<CL 05> The source of CH₄ density is not clearly described in the MR.

<CL 06> Followings are not appropriately provided in the MR:

- 1) "Project emissions" in "Purpose of data" for $LFG_{flare,y}$, $LFG_{electricity,y}$ and $w_{CH_4,y}$ is not relevant.

- 2) Data in "Flare operation parameter" is not included.
- 3) Regarding T and P, calibration frequency "Once a year" and QA/QC procedures "Maintenance free. Only replacement" are contradictory.
- 4) Accuracy class and calibration frequency of electricity meter are not clearly described.

<CL 07> 1) No use of the LFG for the generation of thermal energy is confirmed through on-site assessment, but this information is not clearly reflected in Sections A.1 and E.1 of the MR.

- 2) No use of fossil fuel on-site is confirmed through on-site assessment, but this information is not clearly reflected in Sections D.2 and E.1 of the MR.

<CL 08> 1) Recording frequencies of $LFG_{total,y}$, $LFG_{flare,y}$, $LFG_{electricity,y}$, $WCH_{4,y}$, T and P are not clearly described.

- 2) The description on the measurement conditions (dry or wet) when the residual gas temperature exceeds 60 C is not included for the parameter of $fvCH_{4,h}$.

<CL 09> The calculation procedures for $PE_{flare,y}$ in the hourly data of ER calculation spreadsheet are not clear in the following points:

- 1) How the total hour of flare operation is determined.
- 2) How $PE_{flare,y}$ is calculated in the hourly data sheet.
- 3) Data of temperature and pressure at two monitoring points are not appropriately included in Hourly and Monthly data sheets, whereas these data are included in Minutes data sheets.

<CL 10> Different font other than English is included in the "Electricity generation" sheet of the ER calculation spreadsheet.

5. VERIFICATION AND CERTIFICATION STATEMENT

JQA has performed the 2nd periodic verification of the CDM Project “Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project” (Ref. 1413; registered on 14/03/2008) under the contract with Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.


Verification is the periodic independent review and *ex-post* determination by the DOE of emission reductions from anthropogenic emissions sources of GHGs that have occurred as a result of the registered CDM project activity during the monitoring period. JQA has performed the verification of the registered CDM Project as per VVS to check whether the CDM Project is implemented and operated in accordance with the approved revised PDD, its revised monitoring plan, the applied monitoring methodologies/ tools and decisions/ rulings by Kyoto Protocol, UNFCCC, CMP and CDM EB. The verification process includes the desk review of the relevant documents, on-site assessment including data cross-check and site observation, preparation of Draft Verification Report, resolution of CARs and CLs, internal quality control and the final approval of Verification and Certification Report.

Through the resolution of five CARs and ten CLs, JQA has confirmed that the CDM project activity is implemented and operated in accordance with the approved revised PDD and the registered monitoring plan which complied with the monitoring methodologies ACM0001 (ver. 05). The GHG emission reductions stated in the revised MR (ver. 3.0) and the revised ER calculation spreadsheet (ver. 3.0) are transparently and correctly calculated throughout the 2nd monitoring period from 01/01/2009 to 31/12/2012, which is within the fixed crediting period between 14/03/2008 and 13/03/2018.

As a result of verification, JQA has determined that the certified emission reductions achieved by the CDM Project “Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project” in the 2nd monitoring period between 01/01/2009 and 31/12/2012 are as follows and are free from material errors, omissions or misstatements with a reasonable level of assurance:

Baseline emissions	126,264 tCO ₂ e
Project emissions	0 tCO ₂ e
Emission reductions	126,264 tCO ₂ e

29/08/2013



Tadayuki Yano
Senior Executive
Japan Quality Assurance Organization (JQA)

6. REFERENCES

Category 1: To be submitted to CDM EB

1. Monitoring Report: ver. 1.0 dated 12/06/2013, ver.3.0 dated 14/08/ 2013
2. ER Calculation spreadsheet: ver. 3.0 dated 14/08/2013

Category 2: Others

3. PDD, ver. 03, 27/06/2007
4. Validation Report, DNV, Report No. 2007-1017, Rev. No, 02, 14/09/2007
5. Approved revised PDD, ver. 03.6, 29/09/2012
6. Presentation material on the outline of “Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project”.
7. Business license (Reg.No. 0735534001236) approved by Dept. Business Dev., Ministry of Commerce on 21/11/1991.
8. Regulatory or contractual requirements for LFG collection or combustion in Thailand, TGO Carbon Monthly, Issue 6, June 2009.
9. Layout of Rachathewa Landfill Site (Site-1) with LFG collection pipeline diagram
10. Power purchase agreement (PPA) between JS Co., Ltd. and MEA grid company issued on 14/07/2005.
11. List of equipment & Commissioning Report “Rachathewa Power Plant Project Jaroensompong Co., Ltd.” Issued by Therec Corporation Ltd. on 11/08/2005.
12. Photo of the boundary line between Site-1 and Site-2.
13. Construction contract of LFG collection system between Jaroensompong and Pairojsompongpanich on 01/08/2004.
14. Quotation of gas engine generator (Caterpillar, Type G3516, Output: 1,100 kW (net 1,000 kW)) issued by Metro Machinery Co., Ltd. on 09/10/2005.
15. Specification of gas engine generator issued by Caterpillar.
16. Confirmation letter of commissioning of gas engine generator and test run period (24/02 - 02/03/2006) issued by Metro Machinery Co., Ltd.
17. Grid connection approval issued by MEA grid company on 17/02/2006.
18. Records on major shutdown and events during 2009-2012.
19. Process flow diagram of the LFG collection system with monitoring parameters and points.
20. Specification of LFG flow meters (FL-01, FL-02 and FL-03) issued by Siemens, Operation Instructions Edition 12/2003, Sitrans P-DS III PA Series.
21. Specification of methane analyzer (GA-02) issued by Hitech Instruments Limited.
22. Specification of thermocouple and temperature controllers (TE-01 and TE-03) issued by SHIMAX.

23. Specification of gas pressure transmitters (PR-01 and PR-03) issued by NAGANO.
24. Specification of electricity meter (EL_{EX,LFG} and EL_{IMP}).
25. Certificate of Registration for ISO 9001: 2008 issued on 02/10/2007.
26. Plant Operation Manual prepared by the PPs.
27. Records of the CDM staff training during the 2nd monitoring period.
28. Calibration schedule plan for the monitoring equipment during the 2nd monitoring period.
29. Calibration certificates for LFG flow meters (FL-01, FL-02 and FL-03) during the 2nd monitoring period issued by Isocal Technology Co., Ltd. -Industrial Instrument Calibration Center and Rockertek (Thailand) Co., Ltd.-Calibration Lab.
30. Calibration certificates for thermocouples with temperature controller (TE-01 and TE-03) during the 2nd monitoring period issued by Isocal Technology Co., Ltd. -Industrial Instrument Calibration Center.
31. Calibration certificates for pressure transmitters (PR-01 and PR-03) during the 2nd monitoring period issued by Isocal Technology Co., Ltd. -Industrial Instrument Calibration Center and Rockertek (Thailand) Co., Ltd.-Calibration Lab.
32. Calibration certificates for methane analyzer (GA-02) during the 2nd monitoring period issued by Quality Calibration Co., Ltd.
33. Calibration certificates for electricity meter (EL_{EX,LFG} and EL_{IMP}) during the 2nd monitoring period issued by Meter Testing Section, Meter Division, Distribution Equipment Department of MEA.
34. Certificate of calibration entity "Isocal Technology Co., Ltd." (Accreditation No.: CALIB 0085) issued by Thai Industrial Standards Institute (TISI), Ministry of Industry on 16/09/2009.
35. Certificate of calibration entity "Rockertek (Thailand) Co., Ltd." (Accreditation No.: CALIB 0069) issued by Thai Industrial Standards Institute (TISI), Ministry of Industry on 30/01/2011.
36. Certificate of calibration entity "Quality Calibration Co., Ltd." (Accreditation No.: CALIB 0049) issued by Thai Industrial Standards Institute (TISI), Ministry of Industry on 13/07/2013.
37. Calibration standard for electricity meter (IEC 62053-22).
38. Minutely monitoring data of LFG flow rate, CH₄ concentration, temperature and pressure of the LFG downloaded from the data logger.
39. Hourly data of LFG flow rate, CH₄ concentration, temperature and pressure of the LFG and flare efficiency aggregated from the minutely monitoring data during the 2nd monitoring period.
40. Monthly data of LFG flow rate, CH₄ concentration, temperature and pressure of the LFG aggregated from hourly data including electricity export data during the 2nd monitoring period.

41. Daily logbook of gas engine generator operation.
42. Monthly record of electricity export to the MEA grid company during the 2nd monitoring period.
43. Purchase invoices of electricity export to the grid during the 2nd monitoring period issued by the MEA grid company.
44. Sales record of electricity import from the grid during the 2nd monitoring period issued by the MEA grid company.

7. LIST OF INTERVIEWED PERSONS / ATTENDEES

Jaroensompong Co., Ltd (Project Company)

Ms.Kasinee Jaroenpoj	Project Coordinator
Ms. Souwalak Jaroenpoj	Technical Chief
Mr. Suwatchai Kimjit	Operation / Maintenance Chief

Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.

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CDM VERIFICATION CHECKLIST

Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.

**Jaroensompong Corporation Rachathewa
Landfill Gas to Energy Project
(Ref. 1413)**

Project No. JQA-C0251
(No. 1812000489-491)

29 August 2013



Japan Quality Assurance Organization

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Ref. No. Documents

- 1 Clean development mechanism validation and verification standard (Ver. 04.0)
dated on 29 July 2013 (Annex 4, EB74)
- 2 Clean development mechanism project standard (Ver. 04.0)
dated on 29 July 2013 (Annex 3, EB74)
- 3 Clean development mechanism project cycle procedure (Ver. 04.0)
dated on dated on 29 July 2013 (Annex 11, EB74)
- 4 Guidelines for completing the monitoring report form (ver. 03.2)
dated on 6 December 2012 (Annex 11, EB70)
- 5 ACM0001 : Consolidated baseline and monitoring methodology for landfill gas project activities (ver. 05),
dated on 21 December 2006 (Annex 9, EB28)
- 6 Tool to determine project emissions from flaring gases containing methane,
dated on 15 December 2006 (Annex 13, EB28)

19 Others

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Remarks:

- MoV : Means of Verification
- DR : Desk review refers to CARs/CLs/FARs found out through the desk review for the Monitoring Report/Version 1.0 (completed on 12/06/2013) and Monitoring Report/Version 3.0 (completed on 14/08/2013) taking the background documents related to the requirements for verification into account.
- OA : On-site Assessment
- CAR : Corrective Action Request, raised if one of the following occurs:
 - (a) Non-conformities with the monitoring plan or methodology are found in monitoring and reporting, or if the evidence provided to prove conformity is insufficient;
 - (b) Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impair the estimate of emission reductions;
 - (c) Issues identified in a FAR during validation to be verified during verification have not been resolved by the project participants.
- CL : Clarification Request, raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.
- FAR : Forward Action Request, raised during verification for actions if the monitoring and reporting require attention and/or adjustment for the next verification period.
- NA : Not Applicable to the project activity
- : Pending at the time of the checklist preparation
- /XX/ : Number of the documents referred to

Table 1 Comprehensive Verification requirements based on paragraph 62 of the CDM modalities and procedures

Para. 62	Requirement	Comments	Conc.
(a)	Was it determined whether the project documentation provided is in accordance with the requirements of the registered project design document and relevant provisions of decision 17/CP.7, the present annex and relevant decisions of the COP/MOP?	Yes, the project documentation is in accordance with the approved revised PDD and relevant decisions.	OK
(b)	Was on-site inspections conducted, as appropriate, that may comprise, inter alia, a review of performance records, interviews with project participants and local stakeholders, collection of measurements, observation of established practices and testing of the accuracy of monitoring equipment?	Yes, the on-site inspection was conducted on 17-18/07/2013.	OK
(c)	If appropriate, was additional data from other sources used?	No, additional data was not used.	NA
(d)	Were monitoring results reviewed? And was it verified 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?	Yes, the monitoring results stated in Monitoring Report and ER calculation spreadsheet were reviewed, and it was verified that the methodology (ACM0001 / ver. 05) has been correctly applied and the documentations were complete and transparent.	OK
(e)	Were appropriate changes to the monitoring methodology for any future crediting period recommended to the project participants , if necessary?	No, any change is not needed.	NA

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Para. 62	Requirement	Comments	Conc.
(f)	Were the reductions in anthropogenic emissions by sources of greenhouse gases that would not have occurred in the absence of the CDM project activity determined, based on the data and information derived under subparagraph (a) above and obtained under subparagraph (b) and/or (c) above, as appropriate, using calculation procedures consistent with those contained in the registered project design document and in the monitoring plan?	Yes, through the review of project documents provided by PPs, the on-site inspection and the review of additional data from other sources, it was confirmed that the emission reductions achieved during 01/01/2009 - 31/12/2012 by the project activity were correctly determined using calculation procedures consistent with those contained in the approved revised PDD and the revised monitoring plan.	OK
(g)	Were any concerns relating to the conformity of the actual project activity and its operation with the registered project design document identified and informed the project participants? Have project participants addressed the concerns and supplied relevant additional information?	Five CARs and ten CLs were raised and informed to the PPs through the verification process. The project participants addressed the concerns and supplied relevant additional information.	OK

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Table 2 Requirements for checking the completeness of Monitoring Report and comments raised by verification team

Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
00		IV. General guidelines				
01	4	3. The Project standard requires project participants to prepare a monitoring report for verification and certification by completing a monitoring report form and providing all necessary information and documentation to demonstrate compliance of the project activity with all applicable CDM rules and requirements.	DR	The MR is a fully completed Monitoring Report Form and provides all necessary information and documentation to demonstrate compliance of the project activity with all applicable CDM rules and requirements.	OK	OK
02	4	9. Any data, values and formulae included in electronic spreadsheets provided must be accessible and verifiable.	DR	Data, values and formulae provided in the spreadsheet are accessible and verifiable.	OK	OK
03	4	10. The F-CDM-MR must be completed in English, and all attached documents must be in English or contain a full translation of relevant sections into English. <i>(According to Para. 9 (d) of "GUIDELINES ON COMPLETENESS CHECK OF REQUESTS FOR ISSUANCE", all documents are in English or contain a full translation of relevant sections into English in cases where the DOE considers the provision of the original document to be necessary for the purposes of transparency.)</i>	DR	Different font other than English is included in the "Electricity generation" sheet of ER calculation spreadsheet.	CL 10	OK
04	4	11. The F-CDM-MR must be completed using the same format without modifying its font, document headings, logos, and without any other alteration to the form.	DR	The MR is completed using the same format without modifying its font, document headings, logos, and without any other alteration to the form.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
05	4	12. Tables and their columns in the F-CDM-MR may not be modified or deleted, but rows may be added as needed. Additional appendices may be added.	DR	Tables and their columns in the F-CDM-MR are not modified or deleted.	OK	OK
06	4	13. If a section of the F-CDM-MR is not applicable, it must be explicitly stated that the section is left blank intentionally.	DR	It is explicitly stated as "N/A" in the section of F-CDM-MR where is not applicable.	OK	OK
07	4	14. The format used for presentation of values in the F-CDM-MR should be in an internationally recognized format, for example digit grouping should be done in thousands and a decimal point should be marked with a dot (.), not with a comma (,). <i>(e.g. 1,000 representing one thousand and 1.0 representing one. Large numbers should be presented using the short scale naming system e.g. million = 10^6 and billion = 10^9.)</i>	DR	The format used for presentation of values is in an internationally recognized format.	OK	OK
08	19	5. and 6. Is the CDM-MR the latest version at the time of the publication on UNFCCC CDM website? (If the CDM-Executive Board (the Board) revises the CDM-MR, the revisions will come into effect once adopted by the Board.)	DR	The latest version (03.1) of the Monitoring Report Form is used.	OK	OK
100		V. Specific guidelines				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
101	4	<p>Indicate on the cover page the following information:</p> <p>(a) Title of the project activity;</p> <p>(b) Reference number of the project activity;</p> <p>(c) Version number of the monitoring report;</p> <p>(d) Completion date of the monitoring report (DD/MM/YYYY);</p> <p>(e) Registration date of the project activity (DD/MM/YYYY);</p> <p>(f) Monitoring period number and duration of this monitoring period (first and last days included (DD/MM/YYYY – DD/MM/YYYY));</p> <p>(g) Project participant(s);</p> <p>(h) Host Party(ies);</p> <p>(i) Sectoral scope(s) and applied methodology(ies);</p> <p>(j) Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD;</p> <p>(k) Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period.</p> <p><i>(The information of (a), (B), (C), (e), (f), (g), (h), (i) shall be consistent with that obtained from the registered PDD and the UNFCCC CDM website.)</i></p>	DR	<p>The following information is provided:</p> <p>(a) Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project</p> <p>(b) 1413</p> <p>(c) Version 3.0</p> <p>(d) 14/08/2013</p> <p>(e) 14/03/2008</p> <p>(f) 2nd Monitoring Period (01/01/2009 - 31/12/2012) (4 years and 0 months)</p> <p>(g) Jaroensompong Co., Ltd. and Mitsubishi UFJ Morgan Stanley Securities Co., Ltd.</p> <p>(h) Thailand</p> <p>(i) Sectoral scope 13: Waste Handling and Disposal, ACM0001: Consolidated baseline and monitoring methodology for landfill gas project activities, ver. 05.</p> <p>(j) 239,704 tCO₂e (48 months)</p> <p>(k) 126,264 tCO₂e.</p>	OK	OK
A.1.		Purpose and general description of project activity				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
A.1.01	4	Provide a brief summary of the detailed description given in section B.1 below in terms of: (a) Purpose of the project activity and the measures taken for GHG emission reductions or net anthropogenic GHG removals by sinks; (b) Brief description of the installed technology and equipment; (c) Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.); (d) Total GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period.	DR	<p>The following information is provided:</p> <p>(a) To reduce GHG emissions from the Site-1 of the Rachathewa landfill site, LFG collection system and 1.1 MW electricity generator have been installed and the recovered LFG is being used for electricity generation which is sold to the Metropolitan Electricity Authority (MEA). Excess LFG is flared./1/ (b) An Installation of LFG collection system (horizontal lines and wells), 1.1 MW electricity generator (one unit) and open flare system. /14-16/ (c) Construction completed: June 2005. /13/ Commissioning completed: 11/08/2005. /11/ Continued operation of LFG generation: 03/03/2006. /16, 17/ (d) 126,264 tCO₂e</p> <p>Commissioning date of the LFG electricity generation is not included in Section A.1 of the MR.</p>	CL 01	OK
A.2.		Location of project activity				
A.2.01	4	Provide the following information on the location of the project activity (a) Host Party(ies); (b) Region/ State/ Province, etc.; (c) City/ Town/ Community, etc.; (d) Physical/ Geographical location.	DR	<p>Information on the location of the project activity is included in A.2.</p> <p>(a) Thailand (b) Samuthprakarn (c) Rachathewa, Bangplee (d) Geographical location: 13°41'17.10" N and 100° 43'42.75"E</p> <p>The Project is located at the Rachathewa landfill area, about 30 km east of BMA.</p>	OK	OK
A.3.		Parties and project participant(s)				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
A.3.01	4	List in the table below Party(ies) and project participant(s) involved in the project activity.	DR	Party(ies) and project participant(s) are consistent with the registered PDD and MoC: - Jaroensompong Co., Ltd. (Thailand) - Mitsubishi UFJ Morgan Stanley Securities Co., Ltd. (Japan)	OK	OK
A.4.		Reference of applied methodology				
A.4.01	4	Indicate the exact reference (number, title, version) of: (a) The applied methodology(ies) (e.g. ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities" (Version 11.0)); (b) Any tools and other methodologies to which the applied methodology(ies) refers (e.g. "Tool for demonstration and assessment of additionality" (Version 05.2.1)). Refer to the UNFCCC CDM website for the exact reference of the applied methodologies and tools.	DR	- ACM0001: Consolidated baseline and monitoring methodology for landfill gas project activities, ver. 05. - AMS-I.D : Grid connected renewable electricity generation, ver. 11. - Tool for the demonstration and assessment of additionality, ver. 03. - Methodological Tool to determine project emissions from flaring gases containing methane.	OK	OK
A.5.		Crediting period of project activity				
A.5.01	4	Provide the type, start date and length of the crediting period corresponding to this monitoring period.	DR	Type, start date and length of the crediting period is included in A.5: - Fixed, - 14/03/2008 - 14/03/2008 - 13/03/2018 (10 years)	OK	OK
B.		Implementation of the project activity				
B.1.		Description of implemented registered project activity				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
B.1.01	4	<p>Provide information on the implementation status of the project activity during this monitoring period in accordance with the applicable provision for description of implemented registered CDM project activity in the Project standard.</p> <p>Information on the implementation and actual operation of the project activity, including relevant dates (e.g. construction, commissioning, continued operation periods, etc.). For project activities that consist of more than one site, project participants shall describe the status of implementation and start date of operation for each site. For project activities with phased implementation, project participants shall indicate the progress of the project activity achieved in each phase.</p>	DR/OA	<p>The implementation status of the project activity such as events or situations that occurred during this monitoring period is not detailed in Section B.1 of the MR.</p>	CL 02	OK
B.1.02	4	<p>For the description of the installed technology(ies), technical process and equipment, include diagrams, where appropriate.</p> <p>Note: If applicable, present information on any request for prior approval by the Board of changes to the registered CDM project activity in B.2.1, B.2.2, B.2.3, B.2.4 and/or B.2.5.</p>	DR/OA	<p>The relevant information on the installed technology(ies), technical process and main specification of equipment is not included in Section B.1 of the MR.</p>	CL 03	OK
B.2.		Post registration changes				
B.2.1.		Temporary deviations from registered monitoring plan or applied methodology				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
B.2.1.01	4	<p>Indicate whether any temporary deviations have been applied during this monitoring period. If applied, provide a description of the deviation(s) in accordance with applicable provisions for temporary deviations from the registered monitoring plan or applied methodologies in the Project standard.</p> <p>This should include the reasons for the deviation(s), how it deviates from the monitoring plan and/or applied methodology(ies), the duration for which the deviation(s) is(are) applicable and justification on the conservativeness of the approach.</p> <p>For deviation(s) that require prior approval by the Board, include the date of approval and reference number.</p>	DR/OA	Not applicable.	N/A	N/A
B.2.2.		Corrections				
B.2.2.01	4	<p>Indicate whether any corrections to project information or parameters fixed at validation have been approved during this monitoring period or submitted with this monitoring report.</p> <p>In cases where the correction(s) and the revised PDD are approved prior to the submission of this monitoring report for request for issuance, provide the approval date and reference number. Otherwise, provide the version number and the completion date of the revised PDD.</p>	DR/OA	Not applicable.	N/A	N/A
B.2.3.		Permanent changes from registered monitoring plan or applied methodology				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
B.2.3.01	4	Indicate whether any permanent changes from the registered monitoring plan or applied methodologies have been approved during this monitoring period or submitted with this monitoring report. In cases where the change(s) and the revised PDD are approved prior to the submission of this monitoring report for request for issuance, provide the approval date and reference number. Otherwise, provide the version number and the completion date of the revised PDD.	DR/OA	Not applicable.	N/A	N/A
B.2.4.		Changes to project design of registered project activity				
B.2.4.01	4	Indicate whether any changes to the project design of the project activity have been approved during this monitoring period or submitted with this monitoring report. In cases where the change(s) and the revised PDD are approved prior to the submission of this monitoring report for request for issuance, provide the approval date and reference number. Otherwise, provide the version number and the completion date of the revised PDD.	DR/OA	Not applicable.	N/A	N/A
B.2.5.		Changes to start date of crediting period				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
B.2.5.01	4	Indicate whether any changes to the start date of the crediting period have been approved during this monitoring period or submitted with this monitoring report. In cases where the changes and the revised PDD are approved prior to the submission of this monitoring report for request for issuance, provide the approval date and reference number.	DR	Not applicable.	N/A	N/A
B.2.6.		Types of changes specific to afforestation or reforestation project activity				
B.2.6.01	4	Indicate whether any changes specific to afforestation or reforestation project activities have been applied during this monitoring period based on applicable provisions in the Project standard that do not require prior approval by the Board. If changes were applied, provide the version number and the completion date of the revised PDD.	DR	Not Applicable.	NA	N/A
C.		Description of monitoring system				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
C.01	4	Provide a description of the monitoring system based on the applicable provision for description of monitoring system in the Project standard. 196. Project participants shall describe the monitoring system and provide line diagrams (graphical schemes) showing all relevant monitoring points. This description may include data collection procedures (information flow including data generation, aggregation, recording, calculations and reporting), organizational structure, roles and responsibilities of personnel, and emergency procedures for the monitoring system.	DR/OA	The data collection system and information flow, roles and responsibilities of personnel for monitoring are included in Section C. The relevant information on the data collection procedures (e.g. data reading and recording frequency, and date/time of reading for monthly reporting, etc.) and emergency procedures which is requested by Para. 196 of the PS is not clearly described in Section C of the MR.	CL 04	OK
C.02	4	Include diagrams of the monitoring system and the information flow where appropriate.	DR/OA	The process flow diagram including monitoring parameters and points is not included in Section C of the MR.	CAR 01	OK
D.		Data and parameters				
D.01	4	Provide information on all data and parameters in accordance with applicable provisions for data and parameters in the Project standard, using the tables provided in D.1 and D.2 below.	DR	The information is provided in D.1 and D.2 using the tables, except the issues raised in D.1.01 and D.2.01. Refer to D.1.01 and D.2.01.	OK	OK
D.1.		Data and parameters fixed ex ante or at renewal of crediting period				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
D.1.01	4	Data that are fixed before registration and/or at the renewal of crediting period and are used during this monitoring period should be included here under section D.1. For "Value(s) applied", use one table to report multiple values referring to the same data and parameter, if applicable. Reference(s) to electronic spreadsheets may be used, if necessary.	DR	Fixed values of GWP _{CH4} , AF, EF _{grid} , EF _{OM} , EF _{BM} are included in Section D.1. The source of CH4 density is not clearly described in the MR.	CL 05	OK
D.2.		Data and parameters monitored				
D.2.01	4	For "Monitoring equipment" in the table below , provide information on type, accuracy class, serial number, calibration frequency, date of last calibration and validity. For "Value(s) of monitored parameter", use one table to report multiple values referring to the same data and parameter, if applicable. Reference(s) to electronic spreadsheets may be used, if necessary.	DR/OA	Through the review of relevant documents and on-site assessment, it is confirmed that the information on type, accuracy class, serial number, calibration frequency, date of last calibration and validity of monitoring equipment is provided in D.2. Followings are not appropriately described in the MR: 1) "Project emissions" in "Purpose of data" for LFG_{flare,y}, LFG_{electricity,y} and wCH_{4,y} is not relevant; 2) Data for "Flare operation parameter" is not included; 3) Regarding T and P, Calibration frequency "Once a year" and QA/QC procedures "Maintenance free. Only replacement" are contradictory; 4) Accuracy class and calibration frequency of electricity meter are not clearly described.	CL 06	OK
D.3.		Implementation of sampling plan				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
D.3.01	1	If data and parameters monitored described in section D.2 above are determined by a sampling approach, provide a description on how project participants implemented the sampling efforts and surveys for those data and parameters according to the sampling plan. Include: (a) Description of implemented sampling design; (b) Collected data (electronic spreadsheets may be attached and referenced); (c) Analysis of the collected data; (d) Demonstration on whether the required confidence/precision has been met.	DR/OA	Not Applicable.	NA	N/A
E.		Calculation of emission reductions or GHG removals by sinks				
E.1.		Calculation of baseline emissions or baseline net GHG removals by sinks				
E.1.01	4	Provide sample calculations for all formulae used and calculation of baseline emissions or baseline net GHG removals by sinks, applying actual values. Attach electronic spreadsheets to present full calculations in the monitoring report.	DR	The calculation of baseline emissions using actual values is provided. Calculation spreadsheet is also attached.	OK	OK
E.2.		Calculation of project emissions or actual net GHG removals by sinks				
E.2.01	4	Provide sample calculations for all formulae used and calculation of project emissions or actual net GHG removals by sinks, applying actual values. Attach electronic spreadsheets to present full calculations in the monitoring report.	DR	The calculation of project emissions is included in the baseline emissions calculation in E.1 as per ACM0001 ver. 05. Calculation spreadsheet is also attached.	OK	OK
E.3.		Calculation of leakage				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
E.3.01	4	Provide sample calculations for all formulae used and calculation of leakage, applying actual values. Attach electronic spreadsheets to present full calculations in the monitoring report.	DR	As per ACM0001 ver. 05, leakage is not accounted.	OK	OK
E.4.		Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks				
E.4.01	4	Summarize the results of sections E.1, E.2, E.3 above and provide GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period, using the table below.	DR	The results in E.1, E.2, E.3 are summarized and emission reductions are calculated using the table.	OK	OK
E.5.		Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD				
E.5.01	4	Provide a comparison of actual GHG emission reductions or net anthropogenic GHG removal of the project activity achieved during this monitoring period with the estimates in the registered PDD.	DR	Comparison of actual values of the emission reductions achieved during the 2nd monitoring period with the estimates in the registered PDD is included.	OK	OK
E.6.		Remarks on difference from estimated value in registered PDD				
E.6.01	4	Explain the cause of any increase in the actual GHG emission reductions achieved during this monitoring period based on the applicable provision for calculation of GHG emission reductions in the Project standard.	DR	There is no increase in the actual emission reductions achieved during the 2nd monitoring period.	OK	OK

Table 3 Requirements for Verification and CARs/CLs/FARs requested by the verification team

Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS B.		B. General verification approach				
VVS B.0.07	1	<p>212. In addition to the monitoring documentation the DOE shall review:</p> <p>(a) The registered PDD and the monitoring plan, including any approved revised monitoring plan and/or changes from the registered PDD, and the corresponding validation opinion;</p> <p>(b) The validation report;</p> <p>(c) Previous verification reports, if any;</p> <p>(d) The applied monitoring methodology;</p> <p>(e) The monitoring report to verify that it is as per the standardized format;³³</p> <p>(f) Any other information and references relevant to the project activitys emission reductions (e.g. IPCC reports, data on electricity generation in the national grid or laboratory analysis and national regulations);</p> <p>33 See EB 54 report, annex 34, where the CDM Executive Board has provided a standardized format for the monitoring report to improve consistency in reporting of the implementation and monitoring of the project activity by project participants.</p>	DR	<p>The following documents are reviewed:</p> <p>(a) Approved revised PDD, ver. 03.6, 29/09/2012; /5/ Validation opinion on changes in PDD, 10/01/2013</p> <p>(b) Validation report, DNV, Report No. 2007-1017, Rev. No, 02, 14/09/2007. /4/</p> <p>(c) 1st Verification Report, 10/01/2013</p> <p>(d) ACM0001, "Consolidated baseline and monitoring methodology for landfill gas project activities", ver. 05 (Sectoral Scope, 13);</p> <p>(e) MR, ver. 1.0, 12/06/2013 and revised MR, ver.3.0, 14/08/2013. /1/</p> <p>(f) IPCC data for GWP_{CH4};</p>	OK	OK
VVS B.0.08	1	213. In addition to reviewing the monitoring documentation, the DOE shall determine whether the project participants have addressed the FARs identified during validation or previous verification(s).	DR	No FARs were raised in the previous (1st) verification.	OK	OK
VVS D		D. Verification of compliance				
VVS D.1		1. Compliance of the project implementation with the registered project design document				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.1.02	1	<p>227. The DOE shall, by means of an on-site visit, assess that all physical features of the project activity in the registered PDD are in place and that the project participants have operated the project activity as per the registered PDD or any approved revised PDD. If an on-site visit is not conducted, the DOE shall justify the rationale of the decision.</p> <p>The DOE shall physically visit every project/baseline facilities, irrespective of whether they are used regularly or irregularly, to confirm the compliance of the project implementation with the registered PDD or approved revised PDD.</p>	DR/OA	<p>The on-site visit was conducted on 17-18/07/2013.</p> <p>It is confirmed through the on-site inspection that all physical features of the project activity including monitoring equipment are in place and the PP has operated the project activity as per the approved revised PDD as follows:</p> <ol style="list-style-type: none"> 1) Landfill site /9, 12/ 2) LFG collection system (Blower, Scrubber, etc) /9, 11/ 3) 1.1 MW gas engine electricity generator /14-16/ 4) Open flare 5) Monitoring equipment <ul style="list-style-type: none"> - Gas flow meters: FL-01, 02 and 03 /20/ - Electricity meter /24/ - CH4 analyzer (NDIR) /21/ - Thermocouple: TE-01 and TE-03 /22/ - Pressure transmitter: PR-01 and PR-03 /23/ 	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.1.03	1	<p>228. For each monitoring period, the DOE shall report:</p> <p>(a) The implementation status of the project. For project activities that consist of more than one site, the DOE shall describe the status of implementation and starting date of operation for each site. For project activities with phased implementation, the DOE shall state the progress of the proposed project activity achieved in each phase under verification. If the phased implementation is delayed, the DOE shall describe the reasons and present the expected implementation dates;</p> <p>(b) The actual operation of the project activity;</p> <p>(c) Information (data and variables) provided in the monitoring report that is different from that stated in the registered PDD or any approved revised PDD, and has caused an increase in estimates of the emission reductions in the current monitoring period or is highly likely to increase the estimates of emission reductions in the future monitoring periods;³⁵</p> <p>35 Discrepancies may include higher water availability than expected in the PDD, which may increase the electricity output from a hydropower plant, or a higher plant load factor owing to higher bagasse availability during the crushing season, which increases the production of steam and electricity.</p>	DR/OA	<p>(a) The implementation status of the project was described in Section 3.1.1 of the verification report. The proposed project activity consists of only one site and is not phased implementation;</p> <p>(b) The actual operation of the project was described in Section 3.1.2 of the verification report;</p> <p>(c) The data and variables provided in the MR are consistent with the registered PDD. The comparison of the emission reductions achieved and estimated in the approved revised PDD is described in Section 3.5.3 of the verification report.</p>	OK	OK
VVS D.2		2. Compliance of the monitoring plan with the monitoring methodology including applicable tool(s)				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.2.02	1	<p>230. The DOE shall determine whether the project implementation is in accordance with the provisions of the registered PDD and/or an approved revised PDD.</p> <p>The DOE shall check whether the equations of monitoring parameters described in the monitoring plan are fully in accordance with the applied methodology.</p>	DR/OA	<p>It is confirmed through the review of documents and the on-site assessment that the implementation of the CDM project activity conforms with the description contained in the approved revised PDD.</p> <p>It is confirmed through checking the MR that the equations of monitoring parameters described in the monitoring plan are fully in accordance with the applied methodology.</p>	OK	OK
VVS D.2.03	1	231. For monitoring aspects that are not specified in the methodology, particularly in the case of small-scale methodologies (e.g. additional monitoring parameters, monitoring frequency and calibration frequency), the DOE should bring to the attention of the Board issues which may enhance the level of accuracy and completeness of the monitoring plan.	DR/OA	Not applicable.	N/A	N/A
VVS D.2.04	1	<p>232. The DOE shall provide a statement whether the monitoring plan is in accordance with the approved methodology applied by the registered CDM project activity or an approved revised PDD.</p> <p>The DOE shall provide a statement whether the equations of monitoring parameters described in the monitoring plan are fully in accordance with the applied methodology.</p>	DR/OA	The statement that the monitoring plan is in accordance with the methodology ACM0001 (ver. 05) is provided in Section 3.2 of the verification report.	OK	OK
VVS D.3		3. Compliance of monitoring activities with the registered monitoring plan				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.3.02	1	<p>234. The DOE shall determine whether:</p> <p>(a) The monitoring plan has been properly implemented and followed by the project participants;</p> <p>(b) All parameters stated in the monitoring plan and relevant Board decisions³⁷ have been monitored and updated as applicable, including:</p> <p>(i) Project emission parameters;</p> <p>(ii) Baseline emission parameters;</p> <p>(iii) Leakage parameters;</p> <p>(iv) Management and operational system: the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan.</p> <p>37 For example, a decision at the thirty-fifth meeting of the CDM Executive Board provides clarification for the project activities that apply the approved methodology AM0001. This asks the DOE to check the value of w based on the past one year period during verification, which was not clearly stated in the approved methodology.</p>	DR/OA	<p>It is confirmed through the review of relevant documents and the on-site assessment as follows:</p> <p>(a) The monitoring plan including the measurements of LFG flow rate (LFG_{total,y}, LFG_{flare,y} and LFG_{electricity,y}), CH₄ analysis of LFG collected, electricity generation / consumption and flaring of residual gas stream are implemented by the PPs. /19/</p> <p>(b) All parameters are monitored as follows:</p> <p>(i) Project emission parameters of ELIMP, FVRG_h, fvCH_{4,h}, pCH_{4,n}, η_{flare,h} and flare operation parameter.</p> <p>(ii) Baseline emission parameters of LFG_{total,y}, LFG_{flare,y}, LFG_{electricity,y}, WCH_{4,y}, T, P, ELEX_{LFG}, (ET_y, CEF_{thermal,y}), operation of the energy plant are monitored.</p> <p>(iii) Leakage is not considered as per the methodology.</p> <p>(iv) Monitoring work flow is shown in Fig. 2. The role and responsibility of the staff for monitoring and reporting are in accordance with those in the monitoring plan.</p> <p>1) No use of the LFG for the generation of thermal energy is confirmed through on-site assessment, but this information is not clearly reflected in Sections A.1 and E.1 of the MR.</p> <p>2) No use of fossil fuel on-site is confirmed through on-site assessment, but this information is not clearly reflected in Sections D.2 and E.1 of the MR.</p>	CL 07	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.3.03	1	234. The DOE shall determine whether: (c) The equipment used for monitoring is in accordance with section 4. below and is controlled and calibrated in accordance with the monitoring plan, the applied methodology, the Board guidance, local/national standards, or as per the manufacturers specification;	DR/OA	(c) The calibration date of monitoring equipment such as flow meter, CH₄ analyzer, electricity meter, thermocouple and pressure transmitter in Section D.2 of the MR are not consistent with their calibration certificates.	CAR 02	OK
VVS D.3.04	1	(d) Monitoring results are consistently recorded as per approved frequency; (e) Quality assurance and quality control procedures have been applied in accordance with the monitoring plan or the revised monitoring plan.	DR/OA	<p>(d) 1) Recording frequencies of LFGtotal,y, LFGflare,y, LFGelectricity,y, wCH₄,y, T and P are not clearly described.</p> <p>2) The description on the measurement conditions (dry or wet) when the residual gas temperature exceeds 60 C is not included for the parameter of fvCH₄,h.</p> <p>(e) All of the monitoring equipment are appropriately calibrated annually according to the manufacturer's recommendation. The amount of electricity is crosschecked with sale invoice and record for the imported electricity from the grid.</p>	CL 08	OK
VVS D.3.05	1	235. The DOE shall state whether monitoring has been carried out in accordance with the monitoring plan contained in the registered PDD, approved revised PDD or the accepted revised monitoring plan.	DR/OA	It is stated in Section 3.3 of the verification report that the actual monitoring was implemented in accordance with the registered monitoring plan.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.3.06	1	236. The DOE shall list each parameter required by the monitoring plan and state how it verified the information flow (from data generation, aggregation, to recording, calculation and reporting) for these parameters including the values in the monitoring reports.	DR/OA	The 16 parameters required by the monitoring plan are listed in Section 3.3.1 of the verification report. Verification method of the information flow is also stated in this section.	OK	OK
VVS D.3.04	1	(d) Monitoring results are consistently recorded as per approved frequency; (e) Quality assurance and quality control procedures have been applied in accordance with the monitoring plan or the revised monitoring plan.		(d) 1) <u>Recording frequencies of LFG_{total,y}, LFG_{flare,y}, LFG_{electricity,y}, WCH_{4,y}, T and P are not clearly described.</u> 2) <u>The description on the measurement conditions (dry or wet) when the residual gas temperature exceeds 60 C is not included for the parameter of f_{vCH4,h}.</u> (e) All of the monitoring equipment are appropriately calibrated annually according to the manufacturer's recommendation. The amount of electricity is cross-checked with sale invoice and record for the imported electricity from the grid.	CL 08	OK
VVS D.4		4. Compliance with the calibration frequency requirements for measuring instruments				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.4.01	1	<p>237. The DOE shall determine whether the calibration of those measuring equipments that have an impact on the claimed emission reductions is conducted by the project participants at a frequency specified in the applied monitoring methodology and/or the monitoring plan.</p> <p>If different types of calibration method and/or calibration frequency are applied to single measuring equipment in the monitoring methodology and/or the monitoring plan, the DOE shall confirm whether all different calibration requirements are satisfied.</p>	DR/OA	<p>It is confirmed through the review of calibration certificates and the interview with the PPs that the calibration of measuring equipments is appropriately conducted by the PPs annually according to the manufacturer's recommendation. /28-33/</p> <p>Electricity meter with the accuracy class of 0.2% is replaced with new one every year by MEA grid company.</p> <p>It is confirmed through the check of calibration certificates and the interview with the PPs that CH₄ analyzer is calibrated annually using a standard verified gas (CH₄: 50%).</p> <p>It is confirmed through the interview with the PPs that a zero check is conducted every 2 weeks.</p>	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.4.02	1	<p>238. If, during verification of a certain monitoring period, the DOE identifies that the calibration has been delayed and the calibration has been implemented after the monitoring period in consideration (i.e. the results of delayed calibration are available), the DOE may conclude its verification, provided the following conservative approach is adopted in the calculation of emission reductions:</p> <p>(a) Applying the maximum permissible error³⁸ of the instrument to the measured values taken during the period between the scheduled date of calibration and the actual date of calibration, if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error; or</p> <p>(b) Applying the error identified in the delayed calibration test, if the error is beyond the maximum permissible error of the measuring equipment.</p> <p>38 The maximum permissible errors of all the measuring instruments are specified by the respective manufacturers as part of their technical specifications.</p>	DR/OA	It is confirmed through the review of the calibration certificates and the interview with the PPs that all monitoring equipment are appropriately calibrated without delay.	OK	OK
VVS D.4.03	1	<p>239. The DOE shall confirm that the error has been applied:</p> <p>(a) In a conservative manner, such that the adjusted measured values of the delayed calibration shall result in fewer claimed emission reductions;</p> <p>(b) For all measured values taken during the period between the scheduled date of calibration and the actual date of calibration.</p>	DR/OA	Refer to VVS D.4.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.4.04	1	240. In cases where the results of the delayed calibration are not available, or the calibration has not been conducted at the time of verification, the DOE, prior to finalizing verification, shall request the project participants to conduct the required calibration and shall determine whether the project participants have calculated the emission reductions conservatively using the approach mentioned in paragraph 238 above.	DR/OA	Refer to VVS D.4.02.	OK	OK
VVS D.4.05	1	<p>241. In cases where the DOE determines that it is not possible for the project participants to conduct the calibration at a frequency specified by either the applied methodology, guidance provided by the Board, and/or the registered monitoring plan due to reasons beyond the control of project participants,³⁹ the DOE, shall follow the requirements for post registration changes in section 9.5 of this Standard.</p> <p>³⁹ For example, due to the contractual terms between the project participant and purchasing/selling entities.</p>	DR/OA	Refer to VVS D.4.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.4.06	1	242. In cases where neither the monitoring methodology nor the monitoring plan specify any requirements for calibration frequency for measuring equipments, the DOE shall determine whether the equipments are calibrated either in accordance with the specifications of the local/national standards, or as per the manufacturers specification. If neither local/national standards nor the manufacturers specification are available, international standards may be used. Refer to appendix 1 for an illustrative example to apply the above requirements.	DR/OA	Refer to VVS D.4.02.	OK	OK
VVS D.4.07	1	243. The DOE shall report whether the calibration is conducted at the frequency as specified by the methodology, monitoring plan of the registered PDD or the approved revised monitoring plan. If different types of calibration method and/or calibration frequency are applied to single measuring equipment in the monitoring methodology and/or the monitoring plan, every calibration conducted shall be reported.	DR/OA	It is stated in Section 3.4 of the verification report that the monitoring equipments are yearly calibrated by the certified organization in accordance with the registered monitoring plan. Every two weeks zero check for methane analyzer is also described in this Section.	OK	OK
VVS D.5		5. Assessment of data and calculation of emission reductions				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.5.02	1	<p>245. The DOE shall determine whether:</p> <p>(a) A complete set of data for the specified monitoring period is available.</p> <p>If only partial data are available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan, the DOE shall either raise a CAR for the project participants to comply with the requirements of appendix 1 of the Project standard or submit a request for deviation prior to submitting the request for issuance, if appropriate;</p>	DR/OA	<p>(a)</p> <p>Hourly data of flaring is not included in the ER calculation spreadsheet, in accordance with the tool "Tool to determine project emissions from flaring gases containing methane" (EB26, Annex 13).</p>	CAR 03	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.5.03	1	<p>245. The DOE shall determine whether:</p> <p>(b) Information provided in the monitoring report has been cross-checked with other sources such as plant logbooks, inventories, purchase records, laboratory analysis;</p> <p>The DOE shall cross-check among data measured/aggregated by the same measuring equipment/system but aggregated by different interval (e.g., minutely, hourly, daily, etc.) to confirm the accuracy of the data, with reference to the latest version of “Guideline on the application of materiality in verifications” and “Standard for sampling and surveys for CDM project activities and programme of activities”.</p> <p>The DOE shall cross-check the data measured by measuring equipment with comparable information such as sales/purchase record, production data, energy consumption data, etc. If such information is not available, the DOE shall take alternate attempt to the extent possible.</p>	DR/OA	<p>(b) Hourly data are cross-checked with minutely data (source data) of 540 samples downloaded from the data logger by random sampling to confirm the accuracy and completeness of the data and calculation in the ER calculation spreadsheet, with reference to "guideline" and "Standard". /38-44/</p> <p>1) The amount of exported electricity in Dec 2009 in the ER calculation spreadsheet is not consistent with that of sale invoice.</p> <p>2) The amount of imported electricity in Feb 2009 in the MR and ER calculation spreadsheet is not consistent with that of electricity import records from the grid.</p> <p>3) The aggregation of volumetric flow rate data of the LFG from hourly data to monthly data in Apr and Nov of 2009-2012 is not correctly calculated due to the inappropriate equation in the ER calculation spreadsheet.</p>	CAR 04	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.5.04	1	245. The DOE shall determine whether: (c) Calculations of baseline emissions, and project activity emissions and leakage, as appropriate, have been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology document, and the impact of the irregular or temporal use of backup system, if any, on the calculation of baseline emissions, project emissions, leakage and emission reductions is considered appropriate, in accordance with the formulae and methods described in the monitoring plan and the applied methodology.	DR	(c) Following calculations are not correct in the MR and ER calculation spreadsheet: 1) <u>The unit of methane density is not correct in the calculation of $TM_{RG,h}$ and $PE_{flare,y}$.</u> 2) <u>The values of $w_{CH_4,y}$ are not correct in the calculation of $MD_{flare,y}$.</u>	CAR 05	OK
VVS D.5.05	1	245. The DOE shall determine whether: (c) Calculations of baseline emissions, and project activity emissions and leakage, as appropriate, have been carried out in accordance with the formulae and methods described in the monitoring plan and the applied methodology document, and the impact of the irregular or temporal use of backup system, if any, on the calculation of baseline emissions, project emissions, leakage and emission reductions is considered appropriate, in accordance with the formulae and methods described in the monitoring plan and the applied methodology;	DR	(c) The calculation procedures for PE_{flare} in the hourly data of ER calculation spreadsheet are not clear in the following points: 1) <u>How the total hour of flare operation is determined.</u> 2) <u>How $PE_{flare,y}$ is calculated in the Hourly data sheet.</u> 3) <u>Data of temperature and pressure at two monitoring points are not appropriately included in Hourly and Monthly data sheets, whereas these data are included in Minutes data sheets.</u>	CL 09	OK
VVS D.5.06	1	(d) Any assumptions used in emission calculations have been justified; (e) Appropriate emission factors, 40 IPCC default values and other reference values have been correctly applied.	DR	(d) Any assumptions are not used in emission calculations. (e) IPCC default value for GWP_{CH_4} , CO_2 emission factor of the grid for EF_{grid} are correctly applied to the calculation of baseline and project emissions.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS D.5.07		<p>246. The verification report shall contain:</p> <p>(a) An indication of whether data were not available because activity levels or non-activity parameters were not monitored in accordance with the registered monitoring plan as well as any actions taken by the DOE to ensure that the most conservative assumption theoretically possible has been made;</p> <p>(b) A description of how the DOE cross-checked reported data, and an explanation of the every process, result of cross-check and/or alternate attempt for cross-check;</p> <p>(c) A confirmation that appropriate methods and formulae for calculating baseline emissions, project emissions and leakage have been followed and an assessment whether appropriate method and formulae for calculating baseline emissions, project emissions, leakage and emission reductions have been followed with respect to the irregular or temporal use of backup system, if any;</p> <p>(d) An opinion as to whether assumptions, emission factors and default values that were applied in the calculations have been justified</p>		<p>(a) It is described in Section 3.5.1 of the verification report that a complete set of data for the monitoring period is provided.</p> <p>(b) The description of the cross-check for electricity export was contained in Section 3.5.2 of the verification report.</p> <p>(c) The confirmation of the appropriate methods and formulae for calculating baseline emissions including project emissions is contained in Section 3.5.2 of the verification report.</p> <p>(d) The use of CO2 emission factor of the grid (EFgrid), Adjustment factor (AF), DCH4 and GWPCH4 are justified in Section 3.5.2 of the verification report.</p>	OK	OK
VVS E		E. Post registration changes				
VVS E.0.01	1	247. The DOE contracted by project participants to validate the post-registration changes shall be accredited to the validation function for the specific CDM sectoral scope.	DR	<p>Refer to VVS E.1 - E.5.</p> <p>No post registration change was identified.</p>	NA	NA

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.0.02	1	248. The DOE shall determine whether the changes do not require prior approval by the Board in accordance with appendix 1 of Project standard.	DR/OA	It is confirmed through the desk review and on-site assessment that no post registration changes are identified by or submitted to DOE.	OK	OK
VVS E.0.03	1	249. Where the changes are identified by or submitted to the DOE contracted to conduct the verification, the DOE shall determine whether the changes are solely of a type(s) listed in appendix 1 of the Project standard and: (a) In such cases, the DOE shall submit the changes as part of the request for issuance in accordance with the Project cycle procedure; (b) In all other cases, the DOE shall submit the changes via the request for approval of post registration changes process of the Project cycle procedure.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.0.04	1	250. Where the changes are submitted to a DOE prior to the commencement of verification, the DOE shall submit the changes via the request for approval of post registration changes process of the Project Cycle Procedure.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.1		1. Temporary deviations from the registered monitoring plan and/or monitoring methodology				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.1.02	1	252. If the DOE identifies that the project participants have deviated from the registered monitoring plan and/or methodology, and where the provisions of appendix 1 of the Project standard do not apply, the DOE shall seek prior approval from the Board with respect to the acceptability of the deviations in accordance with the Project cycle procedure.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.1.03	1	253. The DOE shall determine whether the deviation is likely to lead to a reduction in the accuracy of the calculation of emission reductions. In cases where the DOE considers that the deviation will lead to a reduction in the accuracy of the calculation of emission reductions, the DOE shall request the project participants to apply conservative assumptions or discount factors to the calculations to the extent required to ensure that emission reductions will not be over-estimated as a result of the deviation.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.1.04	1	254. For cases where a deviation from the monitoring plan may be applicable to the monitoring period under verification, and part of the subsequent monitoring period, the DOE shall verify the exact period to which the deviation applies.	DR/OA	Refer to VVS E.0.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.1.05	1	255. Where the deviation is identified during verification, the DOE shall indicate in the verification report how the monitoring report reflects the application of the approved guidance from the Board regarding the deviation from the provisions of the registered monitoring plan and/or methodology.	DR/OA	No deviation was identified. Refer to Section 3.6.1 of the verification report.	OK	OK
VVS E.1.06	1	256. Where the deviation is identified prior to verification, the DOE shall state its opinion on whether the deviation reflects the application of the approved guidance from the Board regarding the deviation from the provisions of the registered monitoring plan and/or methodology and as per the applicable provisions of the Project Standard.	DR/OA	No deviation was identified. Refer to Section 3.6.1 of the verification report.	OK	OK
VVS E.2		2. Corrections				
VVS E.2.02	1	258. If the DOE identifies that the project participants have made corrections to project information or parameters determined at validation, the DOE shall determine whether: (a) The corrected information is an accurate reflection of actual project information; and/or (b) The corrected parameters are in accordance with the applied methodology and/or selected monitoring plan.	DR/OA	Refer to VVS E.0.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.2.03	1	259. The DOE shall describe how the corrected information accurately reflects the actual project information and/or how the corrected parameters reflect the application of the applied methodology and/or monitoring plan.	DR/OA	No correction made by the PP was identified. Refer to Section 3.6.2 of the verification report.	OK	OK
VVS E.3		3. Changes to the start date of the crediting period				
VVS E.3.01	1	260. If the project participants wish to change the start date of the crediting period in accordance with section H of the Project standard, the DOE shall determine whether the proposed changes result in a less conservative baseline.	DR	Not applicable. This is the 2nd monitoring period.	NA	NA
VVS E.3.02	1	261. The DOE shall indicate if the requirements in the Project standard have been met and shall submit a request for post registration changes in accordance with the Project cycle procedure.	DR/OA	There is no changes to the start date of the crediting period. Refer to Section 3.6.3 of the report.	OK	OK
VVS E.4		4. Permanent changes from the registered monitoring plan or monitoring methodology				
VVS E.4.02	1	263. The DOE shall determine whether the changes to the monitoring plan contained in the registered PDD proposed by the project participants are in compliance with the applied methodology and do not reduce the level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.	DR/OA	Refer to VVS E.0.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.4.03	1	264. In cases where the proposed changes refer to a later version of the applied methodology in the registered PDD, the DOE shall determine whether the application of any later version of the applied methodology and tools does not impact the conservativeness of the monitoring and verification process, including the related emission reduction calculations.	DR/OA	Not applicable.	NA	NA
VVS E.4.04	1	265. If the DOE identifies that the project participants are unable to implement the monitoring plan contained in the registered PDD and it will not be possible to monitor the registered CDM project activity in accordance with a monitoring plan that would comply with the applied methodology and any applicable tools or the relevant provisions of appendix 1 of the Project standard, the DOE shall request guidance from the Board concerning the acceptability of the permanent changes in accordance with the section on post registration changes in the Project cycle procedure.	DR/OA	Not applicable.	NA	NA

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.4.05	1	266. The DOE shall determine whether the permanent changes are likely to lead to a reduction in the accuracy of the calculation of emission reductions. In cases where the DOE considers that the permanent changes will lead to a reduction in the accuracy of the calculation of emission reductions, the DOE shall request the project participants to apply conservative assumptions or discount factors to the calculations to the extent required to ensure that emission reductions will not be over-estimated as a result of the permanent change.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.4.06	1	267. Where permanent changes are identified during verification, the DOE shall indicate in the verification report how the revised PDD reflects the application of the approved guidance from the Board regarding the permanent changes from the provisions of the registered monitoring plan and/or methodology.	DR/OA	No change from the registered monitoring plan or monitoring methodology was identified. Refer to Section 3.6.4 of the verification report.	OK	OK
VVS E.4.07	1	268. Where permanent changes are identified prior to verification, the DOE shall state its opinion on whether the permanent changes reflect the application of the approved guidance from the Board regarding the deviation from the provisions of the registered monitoring plan and/or methodology.	DR/OA	No change from the registered monitoring plan or monitoring methodology was identified. Refer to Section 3.6.4 of the verification report.	OK	OK
VVS E.5		5. Changes to the project design of a registered project activity				

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.5.02	1	270. If the DOE identifies that the project design in the implementation or operation of the project activity does not conform with the description contained in the registered PDD or the relevant provisions of appendix 1 of the Project standard, the DOE shall request guidance from the Board concerning the acceptability of the proposed or actual changes in accordance with the section on post registration changes in the Project cycle procedure.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.5.03	1	271. In case of actual changes, the DOE shall, by means of an on-site visit and review of the submitted revised PDD by the project participants, which describes the nature and extent of the actual changes, determine whether this description accurately reflects the implementation, operation and monitoring of the modified project activity.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.5.04	1	Refer to VVS E.0.02.	DR/OA	Refer to VVS E.0.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.5.05	1	273. The DOE shall, by means of reviewing the revised PDD against applicable additionality and methodological requirements, determine whether the proposed or actual changes would adversely affect the conclusions of the validation report of the registered PDD with regard to: (a) Additionality of the project activity; (b) Scale of the project activity; (c) Applicability and application of approved baseline methodology under which the project activity has been registered; or (d) The compliance of the monitoring plan with the applied monitoring methodology.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.5.06	1	274. If the proposed or actual changes affect the additionality of the project activity then the DOE shall confirm that: (a) In the case of investment analysis, project participants have only modified the key parameters in the original spreadsheet calculations affected by the proposed or actual changes to the project activity; (b) In the case where only barriers have been claimed to demonstrate additionality, project participants have demonstrated that the barriers are still valid under the new circumstances.	DR/OA	Refer to VVS E.0.02.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.5.07	1	275. In cases where the proposed or actual changes impact the implementation of the project activity and where the original methodology would no longer be applicable, and where the project participant applies a later version of the methodology or another methodology that is applicable to the project activity, the DOE shall confirm that the applied methodology and tools do not impact the conservativeness of the monitoring and verification process and the related emission reduction calculations.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.5.08	1	276. The DOE shall assess whether the revised PDD complies with the applied monitoring methodology and tools or any later version of the methodology or the requirements of another methodology that is applicable to the project activity.	DR/OA	Refer to VVS E.0.02.	OK	OK
VVS E.5.09	1	277. Where the proposed or actual changes are identified during verification, the DOE shall indicate its opinion in the verification report on how the revised PDD reflects the application of the approved guidance from the Board regarding the proposed or actual changes from the provisions of the registered monitoring plan and/or methodology and as per the applicable provisions of the Project Standard.	DR/OA	No change to the project design of a registered project activity was identified. Refer to Section 3.6.5 of the verification report.	OK	OK

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Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.5.10	1	278. Where the permanent changes are identified prior to verification, the DOE shall state its opinion on whether the permanent changes reflect the application of the approved guidance from the Board regarding the deviation from the provisions of the registered monitoring plan and/or methodology and as per the applicable provisions of the Project Standard.	DR/OA	No change to the project design of a registered project activity was identified. Refer to Section 3.6.5 of the verification report.	OK	OK
VVS E.5.11	1	279. The DOE shall provide an opinion containing: (a) A description of the proposed or actual changes as compared to the description in the registered PDD; (b) An assessment on when the changes occurred, reasons for these changes taking place, whether the changes would have been known prior to registration of the project activity, and how the changes would impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD; (c) An assessment regarding whether the changes would adversely affect the conclusions of the validation report of the registered PDD with regard to: (i) Additionality of the project activity; (ii) Scale of the project activity; (iii) Applicability and application of approved baseline methodology under which the project activity has been registered or the later version of the applied methodology; (iv) The compliance of the monitoring plan with applied monitoring methodology; or (v) The level of accuracy of the monitoring compared with the requirements contained in the registered monitoring plan.	DR/OA	No change to the project design of a registered project activity was identified. Refer to Section 3.6.5 of the verification report.	OK	OK

Appendix A

Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.5.12	1	<p>280. In validating the revised PDD containing the proposed and actual changes, and in preparing the validation opinion, the DOE shall include information on how:</p> <p>(a) The proposed revisions ensure that the level of accuracy and completeness⁴¹ in the monitoring and verification process is not reduced as a result of the revision. The DOE shall, using objective evidence, assess the accuracy and completeness of each proposed revision to the monitoring plan, including the frequency of measurements, the quality of monitoring equipment (e.g. calibration requirements, and the quality assurance and quality control procedures);</p> <p>(b) The proposed revisions are in accordance with the monitoring methodology. In cases where the proposed revision refers to a later version of the applied methodology, the DOE shall confirm that this application does not compromise the conservativeness in the monitoring and verification process and of the emission reduction calculations;</p> <p>(c) The findings of previous verification reports, if any, have been taken into account.</p>	DR/OA	No change to the project design of a registered project activity was identified. Refer to Section 3.6.5 of the verification report.	OK	OK
VVS E.5.13	1	<p>281. If the DOE determines that the proposed or actual changes to the project activity comply with the requirements established in the Project Standard, the DOE shall submit the documents to the Board following the Project cycle procedure for post registration changes.</p>	DR/OA	No change to the project design of a registered project activity was identified. Refer to Section 3.6.5 of the verification report.	OK	OK

Appendix A

Section Seq. No.	Ref. No.	Requirement	MoV	Comments	Draft Conc.	Final Conc.
VVS E.5.14	1	282. If the DOE determines that the proposed or actual changes to the project activity do not comply with the requirements established in the Project Standard, the DOE shall issue a negative validation opinion or should request guidance from the Board.	DR/OA	No change to the project design of a registered project activity was identified. Refer to Section 3.6.5 of the verification report.	OK	OK

Table 4 Resolution of CARs and CLs raised during the verification process

Draft Conc.	CARs / CLs raised by the Verification Team	Summary of Project Participant Response	DOE Comments and Conclusion	Final Conc.
CAR 01	The process flow diagram with monitoring parameters and points is not included in Section C of the MR.	The process flow diagram with monitoring points has been added in Section C of the revised MR.	It is confirmed that the process flow diagram with monitoring parameters and points is appropriately added in Section C of the revised MR.	OK
CAR 02	The calibration date of monitoring equipment such as flow meter, CH ₄ analyzer, electricity meter, thermocouple and pressure transmitter in Section D.2 of the MR are not consistent with their calibration certificates.	The calibration date of monitoring equipments listed in Section D.2 has been corrected in the revised MR and are now consistent with the calibration certificates of each meter.	It is confirmed that the calibration dates of monitoring equipment listed in Section D.2 are appropriately corrected in the revised MR and are consistent with those in their calibration certificates.	OK
CAR 03	Hourly data of flaring is not included in the ER calculation spreadsheet, in accordance with the tool "Tool to determine project emissions from flaring gases containing methane" (EB26, Annex 13).	To meet the requirement set by the "Tool to determine project emissions from flaring gases containing methane", the ER calculation spreadsheet was revised to include hourly data of flaring. The project emissions from gas flaring is determined based on the hourly data in the revised CER calculation.	It is confirmed that hourly data of flaring is appropriately added in the revised ER calculation spreadsheet to meet the requirement in the "Flare tool".	OK
CAR 04	1) The amount of exported electricity in Dec 2009 in the MR and ER calculation spreadsheet is not consistent with that of sale invoice. 2) The amount of imported electricity in Feb 2009 in the MR and ER calculation spreadsheet is not consistent with that of electricity import records from the grid. 3) The aggregation of volumetric flow rate data of the LFG from hourly data to monthly data in Apr and Nov of 2009-2012 is not correctly calculated due to the inappropriate equation in the ER calculation spreadsheet.	1) The amount of exported electricity in December 2009 in the ER calculation spreadsheet was corrected to be consistent with that of MEA's electricity purchase statements. 2) A small amount of electricity was imported from the grid in February 2010. The amount of imported electricity in February 2010 is included in the revised ER calculation. 3) Monthly aggregation of LFG from daily data contained systematic error due to erroneous cell reference in the Excell spreadsheet. This systematic error was rectified in the revised spreadsheet. To avoid further systematic error, LFG were calculated directly from hourly data in the revised ER calculation spreadsheet. Errors in the equation have been corrected.	Following corrections are confirmed in the revised ER calculation spreadsheet. 1) The electricity export of 106 MWh is correctly added. 2) The electricity import of 1 MWh is correctly added. 3) The volumetric flow rate data of the LFG in Apr and Nov of 2009-2012 are correctly calculated in the aggregation of monthly data from the hourly data.	OK

Appendix A

Draft Conc.	CARs / CLs raised by the Verification Team	Summary of Project Participant Response	DOE Comments and Conclusion	Final Conc.
CAR 05	Following calculations are not correct in the MR and ER calculation spreadsheet: 1) The unit of methane density is not correct in the calculation of $TM_{RG,h}$ and $PE_{flare,y}$. 2) The values of $w_{CH_4,y}$ are not correct in the calculation of MD_{flare} .	1) Unit conversion factor of 1,000 kg/ton was mistakenly left out in the CER calculation worksheet. This error has been corrected in the revised worksheet as well as in the revised MR. 2) Error in cell reference made in the CER calculation worksheet for w_{CH_4} was corrected in the revised worksheet.	1) It is confirmed that $TM_{RG,h}$ and $PE_{flare,y}$ are correctly calculated in the revised ER calculation spreadsheet. 2) It is confirmed that the correct value of $w_{CH_4,y}$ are used in the calculation of MD_{flare} in the revised ER calculation spreadsheet.	OK
CL 01	Commissioning date of the project plant is not included in Section A.1 of the MR.	Commissioning date of the project plant, 11/08/2005, has been added in Section A.1. of the revised MR.	It is confirmed that the commissioning date of the project plant is added in Section A.1 of the revised MR.	OK
CL 02	The implementation status of the project activity such as events or situations that occurred during this monitoring period is not detailed in Section B.1 of the MR.	Summary of events during the 2nd monitoring period has been included in Section B.1 of the revised MR.	It is confirmed that the summary of major shutdown and events during the 2nd monitoring period is added in Section B.1 of the revised MR.	OK
CL 03	The relevant information on the installed technology(ies), technical process and main specification of equipment is not included in Section B.1 of the MR.	Outline of the project installation, and specification of the major project equipment has been added in the revised MR.	It is confirmed that LFG collection system with blower, LFG utilization system including gas engine generator, open flaring system are described in Section B.1 of the revised MR.	OK
CL 04	The relevant information on the data collection procedures (e.g. data reading and recording frequency, and date/time of reading for monthly reporting, etc.) and emergency procedures which is requested by Para. 193 of the PS is not clearly described in Section C of the MR.	Data collection procedures and emergency procedures have been included in the Section C of the revised MR.	It is confirmed that the relevant information on the data collection procedures and emergency procedures are added in Section C of the revised MR.	OK
CL 05	The source of CH_4 density is not clearly described in the MR.	The source of CH_4 density is the applied methodology ACM0001 ver. 05. Correct reference has been added in the revised MR.	It is confirmed that the parameter of CH_4 density is added in Section D.1 of the revised MR.	OK

Draft Conc.	CARs / CLs raised by the Verification Team	Summary of Project Participant Response	DOE Comments and Conclusion	Final Conc.
CL 06	<p>Followings are not appropriately provided in the MR:</p> <p>1) "Project emissions" in "Purpose of data" for LFG_{flare,y}, LFG_{electricity,y} and WCH_{4,y} is not relevant.</p> <p>2) Data in "Flare operation parameter" is not included.</p> <p>3) Regarding T and P, calibration frequency "Once a year" and QA/QC procedures "Maintenance free. Only replacement" are contradictory.</p> <p>4) Accuracy class and calibration frequency of electricity meter are not clearly described.</p>	<p>1) Parameters are used to calculate baseline emissions. The MR has been revised accordingly.</p> <p>2) Value of monitored parameter for Flare operation parameter was revised to zero in the revised MR.</p> <p>3) Both thermocouple and pressure transmitter are calibrated annually. Actual practice has been accounted in the revised MR.</p> <p>4) Accuracy class of the electricity meter based on the meter catalogue (0.2%) has been included in the revised MR. Calibration frequency of the electricity meter is once a year, and this information has also been included in the revised MR.</p>	<p>Followings are confirmed in the revised MR.</p> <p>1) "project emissions" are correctly removed from "Purpose of data" in LFG_{flare,y}, LFG_{electricity,y} and WCH_{4,y}.</p> <p>2) "Values of monitored parameter" in "Flare operation parameter" is correctly revised from N/A to zero.</p> <p>3) The description of QA/QC procedures for parameters T and P is appropriately revised, based on the actual implementation of calibration.</p> <p>4) Accuracy (0.2%) and calibration frequency (annually) of electricity meter are added in the revised MR, based on the catalogue and calibration certificates.</p>	OK
CL 07	<p>1) No use of the LFG for the generation of thermal energy is confirmed through on-site assessment, but this information is not clearly reflected in Sections A.1 and E.1 of the MR.</p> <p>2) No use of fossil fuel on-site is confirmed through on-site assessment, but this information is not clearly reflected in Sections D.2 and E.1 of the MR.</p>	<p>1) The project does not involve thermal utilization of LFG. The MR has been revised to include this information in the project description in Section A.1. Also, the same information has been added in Section E.1 and relevant explanation was added to justify the removal of MD_{thermal} from the emission reduction calculation.</p> <p>2) There was no fossil fuel consumption during this monitoring period. This information has been added in Sections A.1, D.2, E.1 and E.2 of the revised MR.</p>	<p>1) It is confirmed that "The project does not involve direct utilization of LFG for thermal use" is clearly added in Sections A.1 and E.1.</p> <p>2) It is confirmed that the description relevant to no use of fossil fuel on-site is added in Section D.2, Sections E.1 and E.2 of the revised MR.</p>	OK
CL 08	<p>1) Recording frequencies of LFG_{total,y}, LFG_{flare,y}, LFG_{electricity,y}, WCH_{4,y}, T and P are not clearly described.</p> <p>2) The description on the measurement conditions (dry or wet) when the residual gas temperature exceeds 60 C is not included for the parameter of fvCH_{4,h}.</p>	<p>1) Recording frequencies of LFG_{total,y}, LFG_{flare,y}, LFG_{electricity,y}, WCH_{4,y}, T and P are every one hour. This information was added in the revised MR.</p> <p>2) The description of "The same basis (dry or wet) is considered for this measurement and the measurement of volumetric fraction of all components in the residual gas (fvi,h) when the residual gas temperature exceeds 60C" was provided in the revised MR.</p>	<p>1) It is confirmed that the recording frequency of LFG_{total,y}, LFG_{flare,y}, LFG_{electricity,y}, WCH_{4,y}, T and P are added in the revised MR.</p> <p>2) It is confirmed that the measurement condition of fvCH_{4,h} is added in the revised MR.</p>	OK

Appendix A

Draft Conc.	CARs / CLs raised by the Verification Team	Summary of Project Participant Response	DOE Comments and Conclusion	Final Conc.
CL 09	<p>The calculation procedures for $PE_{flare,y}$ in the hourly data of ER calculation spreadsheet are not clear in the following points:</p> <ol style="list-style-type: none"> 1) How the total hour of flare operation is determined. 2) How $PE_{flare,y}$ is calculated in the hourly data sheet. 3) Data of temperature and pressure at two monitoring points are not appropriately included in Hourly and Monthly data sheets, whereas these data are included in Minutes data sheets. 	<ol style="list-style-type: none"> 1) All hours in the given year when LFG flame is detected is counted toward total hours of flare operation. Revised data sheet provides the specific column indicating the flare operation. 2) $PE_{flare,y}$ calculation has been included in the revised ER calculation spreadsheet. 3) Although the temperature and the pressure before compressor are not the required monitoring parameters, both data have been included in the revised monitored data set. 	<p>Following are confirmed in the calculation procedure of $PE_{flare,y}$.</p> <ol style="list-style-type: none"> 1) The column of "Flare operating hour" is newly added and counted appropriately in the revised ER calculation spreadsheet. 2) The column of "PE_{flare}" is newly added and calculated appropriately in the revised ER calculation spreadsheet. 3) The temperature and pressure data of the LFG at the inlet of the blower are added appropriately in the revised ER calculation spreadsheet. 	OK
CL 10	<p>Different font other than English is included in the "Electricity generation" sheet of ER calculation spreadsheet.</p>	<p>Thai alphabets left in the CER calculation worksheet has been removed.</p>	<p>It is confirmed that Thai alphabets left in the ER calculation spreadsheet is removed in the revised one.</p>	OK

Certificate

Name **Dr. Tadashi Yoshida**
Assessor No. **CDM-AS-104**
Date of registration **8th October 2010**

This is to certify that **Dr. Tadashi Yoshida**
is registered as CDM Assessor
by Japan Quality Assurance Organization.

Date 16th April 2012

Japan Quality Assurance Organization



Senior Executive

Team Leader Qualification

The above mentioned assessor is qualified as Team Leader.

Date of qualification *4th December, 2012*

Date *4th December, 2012*

Japan Quality Assurance Organization



Senior Executive

Appendix B

Grant of technical area within CDM/JI sectoral scope

Name: Dr.Tadashi Yoshida

Sectoral Scope(SS)		Technical Area(TA)		Granted date
SS1	Energy industries (renewable / non-renewable sources)	TA 1.1:	Thermal energy generation from fossil fuels and biomass including thermal electricity from solar (COMPLEX)	
		TA 1.2:	Energy generation from renewable energy sources	28th Dec. 2010
SS2	Energy distribution	TA 2.1:	Electricity distribution	
		TA 2.2:	Heat distribution	
SS3	Energy demand	TA 3.1:	Energy demand	
SS4	Manufacturing industries	TA 4.1:	Cement sector (COMPLEX)	
		TA 4.2:	Aluminum (COMPLEX)	
		TA 4.3:	Iron and steel (COMPLEX)	
		TA 4.4:	Refinery (COMPLEX)	28th Dec. 2010
		TA 4.5:	Chemical industry (COMPLEX)	28th Dec. 2010
		TA 4.6:	Other production	28th Dec. 2010
SS5	Chemical industry	TA 5.1:	Chemical process industries (COMPLEX)	28th Dec. 2010
SS6	Construction	TA 6.1:	Construction	
SS7	Transport	TA 7.1:	Transport	
SS8	Mining/Mineral production	TA 8.1:	Mining and mineral processes, excluding those included in TA 8.2 below	
		TA 8.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS9	Metal production	TA 9.1:	Metal production	
SS10	Fugitive emissions from fuels (solid, oil and gas)	TA 10.1:	Mining and mineral processes, excluding those included in TA 10.2 below	
		TA 10.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1:	Chemical process industries (COMPLEX)	28th Dec. 2010
		TA 11.2:	GHG capture and destruction	
SS12	Solvents use	TA 12.1:	Chemical process industries (COMPLEX)	28th Dec. 2010
SS13	Waste handling and disposal	TA 13.1:	Waste handling and disposal	29th May 2012
		TA 13.2:	Animal waste management	
SS14	Afforestation and reforestation/Land-use, land-use change and forestry	TA 14.1:	Forestry	
SS15	Agriculture	TA 15.1:	Agriculture	
		TA 15.2:	Animal waste management	

This is to certify that Dr. Tadashi Yoshida is granted the above technical areas within sectoral scopes by the Japan Quality Assurance Organization.

Date: 29 May 2012

Director of the Global Environment Department
Japan Quality Assurance Organization

浅輪 紀男 Norio Asawa

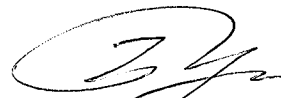
Certificate

Name **Mr. Hiroshi Motokawa**
Assessor No. **CDM-AS-102**
Date of registration **22nd May 2009**

This is to certify that **Mr. Hiroshi Motokawa**
is registered as **CDM** **Assessor**
by Japan Quality Assurance Organization.

Date 16th April 2012

Japan Quality Assurance Organization



Senior Executive

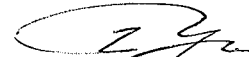
Team Leader Qualification

The above mentioned assessor is qualified as Team Leader.

Date of qualification **12th August 2011**

Date 16th April 2012

Japan Quality Assurance Organization



Senior Executive

Appendix B

Grant of technical area within CDM/JI sectoral scope

Name: Mr. Hiroshi Motokawa

Sectoral Scope(SS)		Technical Area(TA)		Granted date
SS1	Energy industries (renewable / non-renewable sources)	TA 1.1:	Thermal energy generation from fossil fuels and biomass including thermal electricity from solar (COMPLEX)	28th Dec. 2010
		TA 1.2:	Energy generation from renewable energy sources	
SS2	Energy distribution	TA 2.1:	Electricity distribution	
		TA 2.2:	Heat distribution	
SS3	Energy demand	TA 3.1:	Energy demand	
SS4	Manufacturing industries	TA 4.1:	Cement sector (COMPLEX)	
		TA 4.2:	Aluminum (COMPLEX)	
		TA 4.3:	Iron and steel (COMPLEX)	
		TA 4.4:	Refinery (COMPLEX)	
		TA 4.5:	Chemical industry (COMPLEX)	
		TA 4.6:	Other production	
SS5	Chemical industry	TA 5.1:	Chemical process industries (COMPLEX)	
SS6	Construction	TA 6.1:	Construction	
SS7	Transport	TA 7.1:	Transport	
SS8	Mining/Mineral production	TA 8.1:	Mining and mineral processes, excluding those included in TA 8.2 below	
		TA 8.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS9	Metal production	TA 9.1:	Metal production	
SS10	Fugitive emissions from fuels (solid, oil and gas)	TA 10.1:	Mining and mineral processes, excluding those included in TA 10.2 below	
		TA 10.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1:	Chemical process industries (COMPLEX)	
		TA 11.2:	GHG capture and destruction	
SS12	Solvents use	TA 12.1:	Chemical process industries (COMPLEX)	
SS13	Waste handling and disposal	TA 13.1:	Waste handling and disposal	1st Feb.2011
		TA 13.2:	Animal waste management	
SS14	Afforestation and reforestation/Land-use, land-use change and forestry	TA 14.1:	Forestry	
SS15	Agriculture	TA 15.1:	Agriculture	
		TA 15.2:	Animal waste management	

This is to certify that Mr. Hiroshi Motokawa is granted the above technical areas within sectoral scopes by the Japan Quality Assurance Organization.

Date: 16th Apr. 2012

Director of the Global Environment Department
Japan Quality Assurance Organization

浅輪 紀男

Norio Asawa

Certificate

Name **Dr. Tritib SURAMAYTHANGKOOR**
Technical Expert No. **CDM-TE110**
Date of registration **20th June, 2013**

This is to certify that Dr. Tritib SURAMAYTHANGKOOR
is registered as CDM Technical Expert
by Japan Quality Assurance Organization.

Date **20th June, 2013**

Japan Quality Assurance Organization



Senior Executive

Appendix B

Grant of technical area within CDM/JI sectoral scope

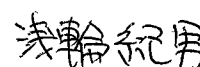
Name: Ms. Tritib Suramaythangkoor

Sectoral Scope(SS)		Technical Area(TA)		Granted date
SS1	Energy industries (renewable / non-renewable sources)	TA 1.1:	Thermal energy generation from fossil fuels and biomass including thermal electricity from solar (COMPLEX)	20 June, 2013
		TA 1.2:	Energy generation from renewable energy sources	
SS2	Energy distribution	TA 2.1:	Electricity distribution	
		TA 2.2:	Heat distribution	
SS3	Energy demand	TA 3.1:	Energy demand	
SS4	Manufacturing industries	TA 4.1:	Cement sector (COMPLEX)	
		TA 4.2:	Aluminum (COMPLEX)	
		TA 4.3:	Iron and steel (COMPLEX)	
		TA 4.4:	Refinery (COMPLEX)	
		TA 4.5:	Chemical industry (COMPLEX)	
		TA 4.6:	Other production	
SS5	Chemical industry	TA 5.1:	Chemical process industries (COMPLEX)	
SS6	Construction	TA 6.1:	Construction	
SS7	Transport	TA 7.1:	Transport	
SS8	Mining/Mineral production	TA 8.1:	Mining and mineral processes, excluding those included in TA 8.2 below	
		TA 8.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS9	Metal production	TA 9.1:	Metal production	
SS10	Fugitive emissions from fuels (solid, oil and gas)	TA 10.1:	Mining and mineral processes, excluding those included in TA 10.2 below	
		TA 10.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1:	Chemical process industries (COMPLEX)	
		TA 11.2:	GHG capture and destruction	
SS12	Solvents use	TA 12.1:	Chemical process industries (COMPLEX)	
SS13	Waste handling and disposal	TA 13.1:	Waste handling and disposal	
		TA 13.2:	Animal waste management	
SS14	Afforestation and reforestation/Land-use, land-use change and forestry	TA 14.1:	Forestry	
SS15	Agriculture	TA 15.1:	Agriculture	
		TA 15.2:	Animal waste management	

This is to certify that Ms. Tritib Suramaythangkoor is granted the above technical areas within sectoral scopes by the Japan Quality Assurance Organization.

Date: 20th June, 2013

Director of the Global Environment Department
Japan Quality Assurance Organization



Norio Asawa

Certificate

Name **Ms. Akiko Furuya**

Reviewer No. **CDM-TR-106**

Date of registration **27th July 2011**

This is to certify that Ms. Akiko Furuya
is registered as CDM Technical Reviewer
by Japan Quality Assurance Organization.

Date **16th April 2012**

Japan Quality Assurance Organization



Senior Executive

Appendix B

Grant of technical area within CDM/JI sectoral scope

Name: Ms. Akiko Furuya

Sectoral Scope(SS)		Technical Area(TA)		Granted date
SS1	Energy industries (renewable / non-renewable sources)	TA 1.1:	Thermal energy generation from fossil fuels and biomass including thermal electricity from solar (COMPLEX)	1st June.2011
		TA 1.2:	Energy generation from renewable energy sources	
SS2	Energy distribution	TA 2.1:	Electricity distribution	
		TA 2.2:	Heat distribution	
SS3	Energy demand	TA 3.1:	Energy demand	
SS4	Manufacturing industries	TA 4.1:	Cement sector (COMPLEX)	
		TA 4.2:	Aluminum (COMPLEX)	
		TA 4.3:	Iron and steel (COMPLEX)	
		TA 4.4:	Refinery (COMPLEX)	
		TA 4.5:	Chemical industry (COMPLEX)	
		TA 4.6:	Other production	
SS5	Chemical industry	TA 5.1:	Chemical process industries (COMPLEX)	
SS6	Construction	TA 6.1:	Construction	
SS7	Transport	TA 7.1:	Transport	
SS8	Mining/Mineral production	TA 8.1:	Mining and mineral processes, excluding those included in TA 8.2 below	
		TA 8.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS9	Metal production	TA 9.1:	Metal production	
SS10	Fugitive emissions from fuels (solid, oil and gas)	TA 10.1:	Mining and mineral processes, excluding those included in TA 10.2 below	
		TA 10.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1:	Chemical process industries (COMPLEX)	
		TA 11.2:	GHG capture and destruction	
SS12	Solvents use	TA 12.1:	Chemical process industries (COMPLEX)	
SS13	Waste handling and disposal	TA 13.1:	Waste handling and disposal	1st June.2011
		TA 13.2:	Animal waste management	1st June.2011
SS14	Afforestation and reforestation/Land-use, land-use change and forestry	TA 14.1:	Forestry	
SS15	Agriculture	TA 15.1:	Agriculture	1st June.2011
		TA 15.2:	Animal waste management	

This is to certify that Ms. Akiko Furuya is granted the above technical areas within sectoral scopes by the Japan Quality Assurance Organization.

Date: 16th Apr. 2012

Director of the Global Environment Department
Japan Quality Assurance Organization

浅井 紀男

Norio Asawa

Certificate

Name **Mr. Hiroshi Kobayashi**

Reviewer No. **CDM-TR-208**

Date of registration **28th June 2011**

This is to certify that Mr. Hiroshi Kobayashi
is registered as CDM Technical Reviewer
by Japan Quality Assurance Organization.

Date **16th April 2012**

Japan Quality Assurance Organization



Senior Executive

Appendix B

Grant of technical area within CDM/JI sectoral scope

Name: Mr. Hiroshi Kobayashi

Sectoral Scope(SS)		Technical Area(TA)		Granted date
SS1	Energy industries (renewable / non-renewable sources)	TA 1.1:	Thermal energy generation from fossil fuels and biomass including thermal electricity from solar (COMPLEX)	28th Jun. 2011
		TA 1.2:	Energy generation from renewable energy sources	
SS2	Energy distribution	TA 2.1:	Electricity distribution	
		TA 2.2:	Heat distribution	
SS3	Energy demand	TA 3.1:	Energy demand	
SS4	Manufacturing industries	TA 4.1:	Cement sector (COMPLEX)	
		TA 4.2:	Aluminum (COMPLEX)	
		TA 4.3:	Iron and steel (COMPLEX)	28th Jun. 2011
		TA 4.4:	Refinery (COMPLEX)	
		TA 4.5:	Chemical industry (COMPLEX)	
		TA 4.6:	Other production	28th Jun. 2011
SS5	Chemical industry	TA 5.1:	Chemical process industries (COMPLEX)	
SS6	Construction	TA 6.1:	Construction	
SS7	Transport	TA 7.1:	Transport	
SS8	Mining/Mineral production	TA 8.1:	Mining and mineral processes, excluding those included in TA 8.2 below	
		TA 8.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS9	Metal production	TA 9.1:	Metal production	
SS10	Fugitive emissions from fuels (solid, oil and gas)	TA 10.1:	Mining and mineral processes, excluding those included in TA 10.2 below	
		TA 10.2:	Oil and gas industry, coal mine methane recovery and use (COMPLEX)	
SS11	Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	TA 11.1:	Chemical process industries (COMPLEX)	
		TA 11.2:	GHG capture and destruction	
SS12	Solvents use	TA 12.1:	Chemical process industries (COMPLEX)	
SS13	Waste handling and disposal	TA 13.1:	Waste handling and disposal	
		TA 13.2:	Animal waste management	
SS14	Afforestation and reforestation/Land-use, land-use change and forestry	TA 14.1:	Forestry	
SS15	Agriculture	TA 15.1:	Agriculture	
		TA 15.2:	Animal waste management	

This is to certify that Mr. Hiroshi Kobayashi is granted the above technical areas within sectoral scopes by the Japan Quality Assurance Organization.

Date: 16th Apr. 2012

Director of the Global Environment Department
Japan Quality Assurance Organization

浅輪 紀男

Norio Asawa

Appendix C

Expertise and Experience of Assessors and Technical Reviewers

Tadashi YOSHIDA

He holds a Bachelor's degree, a Master's degree and Ph.D. in chemical engineering. Before joining JQA, he had been engaged in the research and development in a field of chemical processes for 34 years at a national research institute and published over 100 technical papers and articles mainly about the coal liquefaction and natural gas convention technologies. He has successfully completed GHG Validator/Verifier Training Program and also ISO 14001 Training Course to be qualified as provisional auditor. He has participated in various CDM projects, both validation and verification in JQA.

Hiroshi MOTOKAWA

He holds a Bachelor's degree in economics. Before joining JQA, he had been engaged in planning and management of the recycling facility, also engaged in the studies of Life Cycle Assessment at Consulting firm. His expertise is LCA study including ecological balances of the energy production systems such as thermal power, hydropower, etc. He has successfully completed GHG Validator/Verifier Training Program, also ISO 14001 Training Course to be qualified as a provisional auditor. He has participated in various CDM projects, both validation and verification in JQA.

Tritib SURAMAYTHANGKOOR

She holds a Bachelor's degree in Electronics Engineering, Master's degree in Industrial Management Engineering, and Ph. D. in Energy Technology. Her expertise is biomass energy generation and has published many international journals. She has worked as a senior official in charge of CDM project analysis at Thailand Greenhouse Gas Management Organization. Also she has been involved in power project design, power plant construction and operation.

Akiko FURUYA

She holds a Bachelor's degree in agriculture and Master's degree in environmental study. Before joining JQA, she had worked as an environmental consultant and engaged in environmental and social impact analysis of overseas large-scale

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development projects, survey of overseas environmental legislation and Official Development Assistance (ODA) projects, writing PDD and monitoring reports for CDM projects. She has successfully completed GHG Validator/Verifier Training Program, also ISO 14001 Training Course to be qualified as a provisional auditor. She has participated in various CDM projects, both validation and verification in JQA.

Hiroshi KOBAYASHI

He holds a Bachelor's degree in mechanical engineering. He is a qualified Energy Management Engineer of Heat and Electricity, an Administrator for Pollution Prevention (Air Pollution 1st Class) and also a Boiler Engineer (Special Class).

He had been engaged in an Iron and Steel field for thirty years and also had been involved in the planning and operation in the field of Electricity and Heat production. In JQA, he has done technical review on several verification projects.