



中国质量认证中心
CHINA QUALITY CERTIFICATION CENTRE

VERIFICATION REPORT

(FINAL)

China Quality Certification Centre
(CQC)

**“Tianjin Shuangkou Landfill Gas Recovery and Electricity
Generation Project”**

Report No: CDM-VER-2013-0027

Date: 2013-10-28



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Subject: 4th Periodic Verification	
China Quality Certification Center (CQC) Section 9, No.188, Nansihuan(the South Fourth Ring Road) Xilu (West Road), Beijing 100070, China	Client: International Bank for Reconstruction and Development
Project site(s): This project is located at Shuangkou Landfill Site, Shuangkou Town, Beichen District, Tianjin Municipality, China The geographical co-ordinates are: 38.57-40.25° north latitude and 116.71-118.67° east longitude	
Project Title: Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation Registration Number: 1406	
Monitoring period: 01/01/2012 ~ 31/12/2012 (both days included)	
Applied Methodology/version: ACM0001/version 5 & AMS-I.D./version 10	
First Monitoring Report (MR) version: Date of issuance: 06/03/2013 Version No: 02	Final Monitoring Report (MR) version: Date of issuance: 16/07/2013 Version No: 04
Verified Emission Reductions: 83,407t CO ₂ e	
Work carried by: Mr. Dong Chunsong Ms. Nie Xi	Work reviewed by: Mr. Wang Zhenyang Ms. Wang Keli
Summary of the verification opinion: The client - International Bank for Reconstruction and Development, has commissioned China Quality Certification Centre (CQC) to verify the emission reductions of the project "Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation" (UNFCCC Reference Number 1406) in China against the relevant requirements for CDM project activities. The project activity generates electricity utilizing landfill gas at the project site then supplied to the grid. This verification covers the period from 01/01/2012 to 31/12/2012 (both days included). The verification scope is defined as a periodic independent review and ex post determination by the Designated Operational Entity of the monitored reductions in GHG emissions during the defined monitoring period. CQC verification team conducted document review and a site visit to verify the data and activities submitted in the Monitoring report as per the requirements of VVS	



(version 03.0).

During verification, **3** Corrective Action Requests (CARs) were raised by CQC verification team and successfully closed, attached in the Appendix A of this verification report.

In summary, CQC confirms that:

- The project activity is implemented and operated in accordance with the registered project design document;
- The revised monitoring plan is in accordance with the monitoring methodology including applicable tool (s) applied by the CDM project activity;
- The monitoring activities have been carried out in accordance with the revised monitoring plan;
- The measuring instruments have been calibrated in accordance with the calibration frequency requirements;
- The GHG emission reduction is calculated without material misstatements and the data are recorded and stored as per the monitoring methodology.

Our opinions are related to the project's GHG emissions and the resulting GHG emission reductions reported and related to the valid and registered project baseline and monitoring, and its associated documents. Based on the information reviewed and evaluated, CQC confirms the following statement:

- Reporting Period: 01/01/2012 - 31/12/2012;
- Emission Reductions: **83,407** tCO₂e.

Approved by: Li Guozhen (Vice president of CQC)



Abbreviations

AF	Adjusted Factor
CAR	Corrective Action Request
NCPG	Northern China Power Grid
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CL	Clarification
CO₂	Carbon Dioxide
CO₂e	Carbon Dioxide Equivalent
CQC	China Quality Certification Centre
DOE	Designated Operational Entity
DR	Document Review
EB	Executive Board
FAR	Forward Action Request
GHG	Greenhouse Gas
I	Interview
LFG	Landfill Gas
MoV	Means of Verification
MP	Monitoring Plan
MR	Monitoring Report
PDD	Project Design Document
PP	Project Participant
TCEEE	Tianjin Clean Energy and Environmental Engineering Co., Ltd.
UNFCCC	United nations framework convention on climate change
VVS	Clean Development Mechanism Validation and Verification Standard



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1 INTRODUCTION

The client - International Bank for Reconstruction and Development (“World Bank”) has commissioned China Quality Certification Centre (CQC) to verify the emission reductions of the project “**Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation**” in Tianjin City, P. R. China. This report summarizes the verification objective, scope, methodology and verification finding for the project, with regard to the applicable CDM requirements and VVS^{/1/}. CQC verification team has reviewed the GHG data collected by the PP for the 4th monitoring period covering the time period from 01/01/2012 to 31/12/2012(both days included).

1.1 VERIFICATION OBJECTIVE

The objective of the periodic verification is:

- to ensure that the project activity has been implemented and operated as per the registered PDD and that all physical features of the project are in place;
- to ensure that the monitoring report and supporting documents are completed and verifiable and in accordance with applicable CDM requirements;
- to ensure that actual monitoring systems and procedures comply with the monitoring systems and procedures in the monitoring plan and the approved methodology;
- to evaluate the data recorded and stored as per the monitoring methodology.

1.2 VERIFICATION SCOPE

The verification scope is given as an independent and objective review of the project’s design document, monitoring plan, monitoring report and other relevant documents.

This verification is not intended to provide any consulting services to the project participants. However, stated requests for clarifications and/or corrective actions may provided input for improvement of the project monitoring towards reductions in the GHG emissions.

1.3 VERIFICATION CRITERIA

CQC has performed this verification according to ACM0001 (Version 05), Consolidated baseline and monitoring methodology for landfill gas project activities^{/3/}, AMS-I.D. (Version 10) Grid connected renewable electricity generation^{/2/}, Tool to determine project emission from flaring gases containing methane^{/4/}, the registered PDD^{/5/}, the revised MP^{/29/} and related validation opinion^{/30/}, the verification reports of the previous 3 verifications^{/28/}, PS (version

03.0)^{/34/}, PCP (version 03.2)^{/35/} and VVS (Version 03.0)^{/1/}. In addition, CQC verification team conducted this verification based on CQC's CDM quality manual and procedures.

1.4 HISTORY OF THE VERIFICATION PROCESS

The Monitoring Report (Version 02)^{/6/} was submitted to CQC on 29/03/2013. After completeness check, CQC publicized the Monitoring Report (Version 02) on UNFCCC web site

(<http://cdm.unfccc.int/UserManagement/FileStorage/C7L9P8ZY63MQKXROWB41G0VSEI5NHF>) on 29/03/2013. Based on the submitted documents and registered PDD, document review and a fact finding mission in form of an on-site visit was performed in late April 2013.

Afterwards, CQC here developed draft verification report and issued it to PP for confirmation, taking corrective actions and clarifications.

After reviewing the revised and resubmitted Monitoring Report^{/32/} and relevant evidence, resolutions of the CARs raised, CQC issues this final verification report and a certification report. The main changes between the final version of MR and the MR (Version 02) are:

- MR is revised according to the resolution of the CARs raised during the verification process;
- Typing errors and grammar mistakes are corrected.

2 VERIFICATION METHODOLOGY

2.1 VERIFICATION TEAM APPOINTMENT

Based on the requirements of competency, experience and qualified sectoral scopes, CQC has composed a verification team in accordance with CQC's internal procedures.

Table 1 Verification Team

Qualification	Last name	First name	Country
Verification team leader	Dong	Chunsong	China
CDM verifier	Nie	Xi	China
Technical reviewer	Wang	Zhenyang	China
Technical reviewer	Wang	Keli	China

2.2 DESK REVIEW

PP submitted Monitoring Report (Version 02) on 29/03/2013.

Furthermore, the verification team has used technical information from sources other than Monitoring Report such as registered PDD, Approved methodology



ACM0001 (Version 05), AMS-I.D. (Version 10), host party legislations. The list of reference documents is included in the Appendix C of this final verification report.

In order to ensure the transparency of the decision making process, the reference codes listed in Appendix C of this verification report are used in the CDM Verification Protocol and - as far applicable - in the report itself.

2.3 ON-SITE ASSESSMENT

On 22/04/2013, CQC verification team (Mr. DONG Chunsong & Ms. NIE Xi) conducted an on-site visit for the project to confirm selected information and to resolve issues identified by the verification team in the document review. During the on-site visit, representatives of the PP (TCEEE), project operators (Nanjing Longterm Environment Technology Development Co., Ltd., here in after referred to as Longterm Environment) and the landfill site managers were interviewed. The key interviewees and main topics of the interviews are summarized in Table 2.

Table 2: Interviewees and Interview Topics

Date	Interviewees	Organization	Interview Topics
22/04/2013	Ms. CHEN, Jie (Coordinator)	Shuangkou Landfill Site	Project Implementation <ul style="list-style-type: none"> ● General aspects of the project; ● Technical equipment and the operation of the project; ● Performance of the project;
	Mr. LIU, Baorui (Senior Engineer) Ms. BAI, Xiaohong (Coordinator)	TCEEE	Implementation of Monitoring Plan <ul style="list-style-type: none"> ● Monitoring and measurement equipments; ● Training and practice of the operational personnel; ● Data Management, data quality, archiving and reporting procedures;
	Mr. GU, Yuming (Chief Operating Manager) Ms. HUANG Zhen (CDM Manager)	Longterm Environment	<ul style="list-style-type: none"> ● Calibration of all metering equipments; ● Operation records. ● Cross-check with the sales receipts ● Monitored data and monitoring report. Calculation of GHG reductions

2.4 USE OF THE VERIFICATION PROTOCOL

In order to ensure transparency a verification protocol was customized for the project based on VVS. The protocol shows in transparent manner criteria (requirements), means of verification and findings. The verification protocol serves the following purposes:



- It organizes, details and clarifies the requirements emission reduction is expected to meet;
- It ensures a transparent verification process where the verifier will document how a particular requirement has been validated and the result of the verification.

The verification protocol consists of two tables. The different columns in these tables are described in the figure below. The verification protocol to be completed by PP for the project is enclosed in Appendix A to this report.

Negative findings established during the verification can either be seen as a non-fulfillment of CDM criteria or where a risk to the fulfillment of the implementation of emission reduction is identified.

Corrective action requests (CARs) are issued, where:

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

Clarifications (CLs) are issued if the information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

Forward action requests (FARs) are issued if the monitoring and reporting require attention and/or adjustment for the next verification period.

Verification Protocol Table 1:				
verification checklist for Clean Development Mechanism (CDM) Project Activities				
Verification checklists	Reference	Means of verification (MoV)	Verification findings	Draft and/or Final Conclusion
<i>The various requirements in Table 2 are linked to checklist questions the project should meet. The checklist is organized in different sections, following VVS (Version 03.0)</i>	<i>Gives reference to documents where the answer to the checklist question or item is found.</i>	<i>Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I).</i>	<i>The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the</i>	<i>This is either acceptable based on evidence provided (OK), or a corrective action request (CAR) due to non-compliance with the checklist question (See below). A request for clarification (CL) is used when the</i>



		<i>N/A means not applicable.</i>	<i>conclusions reached.</i>	<i>verification team has identified a need for further clarification.</i>
Verification Protocol Table 2: Resolution of Corrective Action and Clarification Requests				
Draft report clarifications and corrective action requests	Ref. to checklist question in table 1	Summary of PP's response	Verification conclusion	
<i>If the conclusions from the draft Verification are either a CAR or a CL, these should be listed in this section.</i>	<i>Reference to the checklist question number in Table 1 where the CAR or CL is explained.</i>	<i>The responses given by the project participants during the communications with the verification team should be summarised in this section.</i>	<i>This section should summarise the verification team's responses and final conclusions. The conclusions should also be included in Table 1, under "Final Conclusion".</i>	

2.5 FINAL VERIFICATION REPORT

The draft verification report containing 2 CARs were submitted to the PP to be confirmed and to take corrective action for addressing the CARs issued by CQC verification team. After reviewing the final MR^{/32/} and response of the CARs raised, CQC issues this final verification report and certification report.

2.6 INTERNAL QUALITY CONTROL

This final verification report including the initial verification findings undergoes an internal technical review before being submitted to PP and requesting issuance of CERs according to CQC internal procedure CDMP09. The technical review was performed by two technical reviewers qualified in accordance with CQC's internal procedure CDMP01.

3 VERIFICATION FINDINGS

As mentioned above all findings are summarized in Table 1 of the attached verification protocol.

3.1 REMAINING CARS, CLS, AND FARS DURING PRIOR VERIFICATION

There was a FAR raised during the 1st verification. This FAR was to revise the monitoring plan from the registered PDD. The PP then revised the MP and submitted to CQC in December 2010. CQC validated this revised MP^{/29/} and signed a validation opinion^{/30/} and submitted to the UNFCCC secretariat. This MP revision was approved on 01/07/2011, and this FAR was closed successfully. No remaining/outstanding issues during the 2nd and 3rd verification^{/28/}.

3.2 COMPLIANCE OF THE PROJECT IMPLEMENTATION WITH THE REGISTERED PDD

This project was registered on 27/08/2008, with a renewable crediting period; the first crediting period is from the date of registration to 26/08/2015. The project reference number is 1406. This is the 4th monitoring period, which covers a period from 01/01/2012 to 31/12/2012 (both days included).

A gas collection system, a gas pretreatment system, an enclosed flare system and 2 CAT generator units and their appendix have been installed on-site. As the quantity of landfill gas was not enough for 3 generator units during this proposed monitoring period, the 3rd generator unit was not installed during this monitoring period and planned to be installed based on the quantity of landfill gas during this crediting period and 1 more to be installed during the 2nd crediting period. While during this verification, it was found that as per the registered IRR calculation spreadsheet up to 4 generators with 1250 kW capacity (manufactured by Deutz, according to the PDD) will be implemented during the 1st crediting period, while the final monitoring report stated, on Section B.1, that two units with 1.03 MW capacity each (manufactured by CAT) were in operation during the monitoring period. With respect to this issue **CAR01** was raised during this verification and successfully closed out. (Ref. Appendix A: CDM Verification Protocol - Table 2).

The PP signed the *Grid connected agreement*^{27/} in Oct. 2010 and two *Power Purchasing Agreements*^{27/} with the local grid company in April 2011 and May 2012 respectively. The valid periods of these documents can cover this monitoring period. The installed generator has generated electricity power and supplied to Northern China Power Grid (NCPG). This has been confirmed by CQC verification team during the on-site visit.

The measurement equipments are installed on-site, which is shown in the MR. All these equipments are calibrated by accredited third-party entity in accordance with Chinese national standards within this monitoring period. The detailed descriptions of the monitoring equipments' verification are described in Appendix D of this final verification report. This has been confirmed by CQC verification team during the on-site visit.

According to Para. 228 of VVS ver. 03.0, CQC verification team confirms that:

- The implementation and equipments installation of the project activity are consistent with the registered PDD and the revised MP;
- The actual operation of the proposed CDM project activity is as per the registered PDD and the revised MP;
- Information (data and variables) provided in the monitoring report is in accordance with that stated in the registered PDD and the revised MP.

3.3 COMPLIANCE OF THE MONITORING PLAN WITH THE MONITORING METHODOLOGY INCLUDING APPLICABLE TOOL(S)

The approved consolidated monitoring methodology ACM0001 “*Consolidated monitoring methodology for landfill gas project activities* Version” (05) is applied to the project and the approved small-scale methodology AMS-I.D. “*Grid connected renewable electricity generation*” (Version 10) is used for the energy displacement component.

The revised monitoring plan contains:

- The installation of metering equipment & systems;
- The management structure of the project and management responsibilities for relevant person in the project;
- Training
- Internal inspection
- Gas field monitoring records management
- Monitoring data evaluation
- Equipment Calibration and maintenance
- Corrective actions
- Site audits
- Documents storage
- Emergency preparedness for unintended emissions

PP has developed an Operations Monitoring Plan^{/7/} according to the above monitoring plan. PP has implemented the monitoring plan as per the manual during this monitoring period.

As per the requirements of Paragraph 232 of VVS version 03.0, CQC verification team confirms that the monitoring plan which was described in the Monitoring report is in accordance with the approved monitoring methodology applied by the project.

3.4 COMPLIANCE OF MONITORING ACTIVITIES WITH THE REGISTERED MONITORING PLAN

3.4.1 Monitoring of all parameters stated in revised monitoring plan

3.4.1.1. $LFG_{total, y}$: Total amount of landfill gas captured in year y (Nm³)

As per the registered PDD and the revised MP^{/29/}, this parameter is measured by a flow meter continuously and aggregated monthly and yearly. 100% of the data are to be monitored and all data will be archived electronically. The verification findings during on-site visit are as follows:

A Vortex flow meter (Manufactured by Wu Xi Qiu Xin Flowmeter Co., Ltd., Model:



LU150, SN: 10150G179) with $\pm 1.5\%$ ^{/8/} is well installed on the main pipe and was checked by CQC verification team during the onsite visit. The flow meter is in good condition. The verification report of onsite installation and commissioning^{/9/} was verified.

CQC reviewed the operation log and found the flow meter was replaced on Mar.5th 2012 alone with routine maintenance during this monitoring period. The detailed information of the meters is listed in Appendix D "*Measurement Equipments List*" of this report.

This parameter is measured continuously by the flow meter and normalized to 0°C, 1atm automatically with continuously measured temperature and pressure. Normalized reading is recorded by computer system. CQC team checked the computer algorithm which is used for converting the data under actual working condition into that under normal condition and found it correct.

Reading converted under standard temperature and pressure condition of the flow meter is recorded by computer system at one minute interval. Then site CDM manager checks the data and archives them in a detailed CDM spreadsheet^{/10/}.

The hourly flow is calculated as the sum of 60-minute flow data and then aggregated daily, weekly, monthly and yearly in the detailed CDM monitoring spreadsheet.

Site CDM manager checks the condition of the flow meter every day^{/33/} and did not found any breakdown during this monitoring period.

CQC team confirms that $LFG_{total, y}$ has been verified to be monitored as per the revised monitoring plan^{/29/}.

3.4.1.2. $LFG_{electricity, y}$: Amount of landfill gas combusted in power plant in year y (Nm^3)

As per the registered PDD and the revised MP^{/29/}, this parameter is measured by a flow meter continuously and aggregated monthly and yearly. 100% of the data are to be monitored and all data will be archived electronically. The verification findings during on-site visit are as follows:

A Vortex flow meter (Manufactured by Beijing Kunlun Seaside Sensor Technology Center, Model: LUGB151, SN: V15025015) with $\pm 1.5\%$ ^{/11/} is well installed on the generator branch pipe and was checked by CQC team. The flow meter is in good condition. Verification report of onsite installation and commissioning^{/9/} was verified and the meter was installed correct and in good condition then.

CQC reviewed the operation log^{/33/} and found the flow meter was replaced on Mar.5th 2012 and Jul.5th 2012 respectively during this monitoring period. The detailed information of the meters is listed in Appendix D "*Measurement Equipments List*" of this report.

This parameter is measured continuously by the flow meter and normalized to 0°C, 1atm automatically with continuously measured temperature and pressure. Normalized reading is recorded by computer system. CQC team checked the



computer algorithm which is used for converting the data under actual working condition into that under normal condition and found it correct.

Reading converted under standard temperature and pressure condition of the flow meter is recorded by computer system at one minute interval. Then site CDM manager checks the data and archives them in a detailed CDM spreadsheet^{/10/}.

The hourly flow is calculated as the sum of 60-minute flow data and then aggregated daily, weekly, monthly and yearly in the detailed CDM monitoring spreadsheet; a compared column (comparable on minute base), which indicated the smaller values of $LFG_{electricity}$ and LFG_{total} minus LFG_{flare} is used in the calculation of $MD_{electricity}$ for conservativeness; in this case, the value of $LFG_{electricity}$ is taken if the value of $LFG_{electricity}$ is smaller than the value of LFG_{total} minus LFG_{flare} , otherwise, the value of LFG_{total} minus LFG_{flare} is taken.

Site CDM manager checks the condition of the flow meter every day^{/33/} and did not found any breakdown during this monitoring period.

CQC team confirms that $LFG_{electricity, y}$ has been verified to be monitored as per the revised monitoring plan^{/33/}.

3.4.1.3. $LFG_{flare, y}$: Total amount of landfill gas to flares in dry basis at normal conditions, in year y (Nm^3)

As per the registered PDD and the revised MP^{/29/}, this parameter is measured by a flow meter continuously and aggregated monthly and yearly. 100% of the data are to be monitored and all data will be archived electronically. The verification findings during on-site visit are as follows: A Vortex flow meter (Manufactured by Wu Xi Qiu Xin Flowmeter Co., Ltd., Model: LUGB100, SN: 10100G178) with $\pm 1.5\%$ ^{/12/} is well installed on the flare branch pipe and was checked by CQC team. The flow meter is in good condition. Verification report of onsite installation and commissioning^{/9/} was verified.

CQC reviewed the operation log and found the flow meter was replaced on Jul.11^h 2012 during this monitoring period. The detailed information of the meters is listed in Appendix D "Measurement Equipments List" of this report.

Site CDM manager checks the condition of the flow meter every day and did not found any breakdown during this monitoring period.

As the LFG was all sent to the power generators and the flare was not used at all during the whole monitoring period, the relative monitoring value of $LFG_{flare, y}$ were zero, this is also consistent with the daily log books^{/33/}; the project owner does not claim the emission reductions of the flare.

CQC team confirms that $LFG_{flare, y}$ has been verified to be monitored as per the revised monitoring plan.

3.4.1.4. $\omega_{CH_4, y}$: Methane Fraction in Landfill Gas (m^3CH_4/m^3LFG)

As per Registered PDD and the revised MP^{/29/}, this parameter is measured continuously by continuous gas quality analyzer. 100% of all data are measured and archived electronically. The verification findings during on-site visit are as follows:



A methane fraction meter (made by made by Wu Han Si Fang photo electricity technology Co., Ltd., Model: GASBOARD-3200, SN: 10803210106100000051) with 2%^{/13/} is installed on the main pipe of LFG. The equipment was checked by CQC team during the site visit and found it was in good condition.

CQC reviewed the operation log and found the methane fraction meter was replaced on Dec.13th 2012 during this monitoring period. The detailed information of the meters is listed in Appendix D "*Measurement Equipments List*" of this report.

This parameter is measured continuously by the methane fraction meter on the main pipe. The reading is recorded by computer system at one minute intervals. Site CDM manager checks the data and archives them in the detailed CDM monitoring spreadsheet to calculate mass flow of Methane.

To cross check the reading, the methane concentration is also measured at least once a day using a proprietary hand held infra red portable GEM 2000^{/14/} landfill gas analyzer. The measured results are recorded manually in the operation log^{/33/}.

CQC team confirms that $\omega_{CH_4, y}$ has been verified to be monitored as per the revised monitoring plan.

3.4.1.5. $FV_{RG, h}$: volumetric flow rate of the residual gas in dry basis at normal conditions in the hour h

As per Registered PDD and the revised MP^{/29/}, this parameter is the same as the parameter $LFG_{flare, y}$ and will be measured by a continuous flow meter and PP shall ensure that the same basis is considered for this measurement and the measurement of the volumetric fraction of all components in the residual gas when the residual gas temperature exceeds 60°C.

As no residual LFG was flared during this monitoring period, the monitored values of $LFG_{flare, y}$ were zero and so $FV_{RG, h}$ were Zero too.

3.4.1.6. $fv_{i, h}$: Volumetric fraction of component i in the residual gas in the hour h , where $i = CH_4, CO, CO_2, O_2, H_2, N_2$

As per the Registered PDD and the revised MP^{/29/}, this parameter is measured by PP using a continuous gas analyzer and PP shall ensure that the same basis is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG, h}$) when the residual gas temperature exceeds 60°C. The verification findings during on-site visit are as follows:

According to Annex 13 of EB 28 "*Tool to determine project emission from flaring gases containing methane*", a simplified approach was applied by PP in this project, the PP only measured the methane content of the residual gas and considered the remaining part as N_2 .

A methane fraction meter (made by Wu Han Si Fang photo electricity technology Co., Ltd., Model: GASBOARD-3200, SN: 11201060106100000019) with 2%^{/13/} is installed on the flare pipe. The equipment was checked by CQC team during the site visit and found it was in good condition.

CQC reviewed the operation log and found the methane fraction meter was



replaced on Feb.8^h 2012 during this monitoring period. The detailed information of the meters is listed in Appendix D“*Measurement Equipments List*” of this report. As no residual LFG was flared during this monitoring period, the monitoring of this parameter was not necessary during this monitoring period.

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

As per the Registered PDD and the revised MP^{/29/}, this parameter is to be measured by on site electricity meter continuously, 100% of data are monitored and are cross checked with receipts from the power supplier company. The electricity meter is to be calibrated regularly according to manufacturer's instructions. The verification findings during on-site visit are as follows:

An electricity meter^{/16/} (made by Yantai Oriental Electric Co., Ltd., Model: DSSD178, bi-directional, 0.5S, SN: L4J0760047662170) is well installed on site. Verification report of on-site installation and commissioning^{/9/} was verified. The local state grid company record the reading every hour automatically and calculate the monthly amount of electricity at 24:00 o'clock on the last day of every month. CQC team cross checked this parameter with Monthly electricity balance sheet^{/17/} which was stated by local State Grid Company and the electricity sales invoices and found the all of the data consistent. The verification team also cross-checked the ER spreadsheet against the operational log books^{/33/} and confirms that the downtime of electricity system during this monitoring period was because of the maintenance of the electricity system.

CQC team confirms that $EL_{EX, LFG}$ has been verified to be monitored as per the revised monitoring plan.

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

As per the registered PDD and the revised MP^{/29/}, this parameter is continuously measured by electricity meter and cross checked with electricity invoices. The verification findings during on-site visit are as follows:

An electricity meter^{/18/} (made by Yantai Oriental Electric Co., Ltd., Model: DTSD178, bi-directional, 0.5S, SN: 070764286942) is well installed at the project site. Verification report of on-site installation and commissioning^{/9/} was verified. The local state grid company record the reading every hour automatically and calculate the monthly amount of electricity and issue sales receipt every month.

CQC reviewed the operation log and found the meter was replaced on Jul.5^h 2012 during this monitoring period. The detailed information of the meters is listed in Appendix D“*Measurement Equipments List*” of this report.

CQC team cross checked this parameter with sales receipts^{/19/} which were issued by local State Grid company and found the monthly values of EL_{IMP} at Jul. Aug. Oct. and Nov. of 2012 in the ER calculation spreadsheet version 01 were inconsistent with the sales receipts. With respect to this issue **CAR02** was raised during this verification and successfully closed out. (Ref. Appendix A: CDM Verification Protocol - Table 2).



The verification team also cross-checked the ER spreadsheet against the operational log books^{/33/} and confirms that the downtime of electricity system during this monitoring period was because of the maintenance of the electricity system.

CQC team confirms that **EL_{IMP}** has been verified to be monitored as per the revised monitoring plan.

3.4.1.9. Annual operation hours: annual operation hours of the generators (h/year)

As per the Registered PDD and the revised MP^{/29/}, this parameter is on-site measured by PP and recorded annually. 100% of all data are measured and archived electronically. The verification findings during on-site visit are as follows:

The parameter was measured by an hour meter^{/20/} (made by the manufacture of Tianjin Kunlun Tianchen Meter Co. Model: JS/A-H8T1V1N1) installed on the Generator #1. The measured result of this parameter (8,365h) was checked by CQC verification team and cross checked with the daily working log; an hour meter^{/20/} (made by the manufacture of Tianjin Kunlun Tianchen Meter Co., Model: JS/A-H8T1V1N1) is installed on the Generator #2 and the measured result of this parameter (8,409h) was checked by the team and cross checked with the daily working log books. It is found reasonable. The detailed information of the meters is listed in Appendix D“*Measurement Equipments List*” of this report.

3.4.1.10. P: Pressure of the LFG (Pa)

As per the revised Monitoring Plan^{/29/}, this parameter is measured by a pressure meter. The verification findings during on-site visit are as follows:

A pressure meter^{/21/} (made by the manufacture of Beijing Kunlun Seaside Sensor Technology Center. Model: JYB-KB-PAG, SN: 08030358) with 0.5% was well mounted in the main gas pipe. The pressure has been measured continuously and recorded at one minute interval in computer system. Site CDM manager checks the data and archives them in the detailed CDM monitoring spreadsheet. The pressure is used for calculation of the density of methane combined with the corresponding temperature.

CQC reviewed the operation log and found the meter was replaced on Jul.5^h 2012 during this monitoring period. The detailed information of the meters is listed in Appendix D“*Measurement Equipments List*” of this report.

While **CAR03** was raised as the following: The parameter P was not included in section D.2 Data and parameters monitored of the MR version 02 (the GSP version). This CAR was successfully closed out by PP during this verification. (Ref. Appendix A: CDM Verification Protocol - Table 2).

3.4.1.11. T: Temperature of the Landfill Gas (°C)

As per the revised monitoring plan^{/29/}, this parameter is measured by a temperature meter. The verification findings during on-site visit are as follows:

A temperature meter^{/22/} (made by the manufacture of Beijing Kunlun Seaside Sensor Technology Center. Model: JWB/P251, SN: K80314) with 0.5% was well



mounted in the main gas pipe between the gas treatment package and the first flow meter. The temperature of LFG has been measured continuously and recorded at one minute interval in computer system. Site CDM manager checks the data and archives them in the detailed CDM monitoring spreadsheet. The temperature is used for calculation of the density of methane combined with the corresponding pressure.

CQC reviewed the operation log and found the meter was replaced on Jul.5^h 2012 during this monitoring period. The detailed information of the meters is listed in Appendix D “*Measurement Equipments List*” of this report.

3.4.1.12. Flare operation parameters

As per the Registered PDD and the revised MP^{/29/}, this parameter is monitored according to “*Tool to determine project emissions from flaring gases containing Methane*” and manufacturer’s requirements. The verification findings during on-site visit are as follows:

An enclosed flare^{/23/} was well installed on the project site. During this monitoring period, the flare system was not operated, thus PP doesn’t claim the CER caused by flaring.

3.4.1.13. T_{flare} : Temperature of the exhaust gas of the enclosed flare(°C)

As per the Registered PDD and the revised MP^{/29/}, this parameter is monitored by a type N thermocouple. A temperature above 500°C indicates that a significant amount of gases are still being burnt and that the flare is operating. As per the “*Tool to determine project emission from flaring emission from flaring gases containing methane*”, this parameter is used for determination of the hourly flare efficiency. The verification findings during on-site visit are as follows:

Three Type N thermocouples^{/24/} (made by the manufacture of Nanjing Wanda Meter Manufacture, Model: WRNB-430) with class II were well installed at the top half part of flare. CQC team checked the operation records of the flare and found that during this monitoring period, the flare system was not operated, PP doesn’t claim the CERs caused by flaring.

CQC verification team confirms that not claiming the CERs caused by flaring is reasonable and acceptable.

3.4.1.14. Laws and regulations about waste management system in China

As per ACM0001 version 5, this parameter is required for any changes to the adjustment factor (AF) or $MD_{reg, y}$ and is updated at renewal of the crediting period. The verification findings during on-site visit are as follows:

The Chinese national standard - “*Standard for pollution control on the landfill site of Municipal Solid Waste (GB16889-2008)*”^{/25/} was published in 2008 and is effective from 1st July 2008 onwards. Wherein, solid waste landfill site requirements, infrastructure design and construction requirements of solid waste landfill site, admission requirements of solid waste landfill disposal have been added or amended. This has no impact on parameters monitored during this

crediting period. Therefore, **AF** remains zero.

3.4.2 Management System and Quality Assurance

PP has developed a management system and quality assurance procedure, which is documented in *Operations Monitoring Plan*^{71/}; the 2 internal audits^{131/} were held in June 2012 & December 2012, respectively, during this monitoring period. CQC verification team confirms this through reviewing the records and interviewing the interviewees during on-site visit. As per the Operations Monitoring Plan (CDM Monitoring & Quality Control Manual), PP has implemented the management system generally.

Therefore, as per the requirements of Paragraph 235 and 236 of VVS version 03.0, CQC verification team confirms that the monitoring is in accordance with the revised monitoring plan.

3.5 COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS FOR MEASURING INSTRUMENTS

The calibration frequency requirements for the measuring instruments and relate calibration information are listed in Appendix D “*Measurement Equipments List*” of this report.

CQC team has carefully checked the information in the table 1 of final MR with related nameplates of these measuring instruments, operation logs, relate calibration reports and confirms they are consistent. CQC team noted that the flare system was not operated during this monitoring period, while the measuring instruments attached to the flare were also installed and calibrated as per related requirements. All the involved instruments are calibrated as related calibration frequency requirements.

Therefore, as per the VVS (Version 03.0), CQC verification team confirms that the calibration is conducted at the frequency as specified by the revised monitoring plan of the project.

3.6 ASSESSMENT OF DATA AND CALCULATION OF GHG EMISSION REDUCTIONS

According to ACM0001 (version 05), the registered PDD and the Monitoring Report, the emission reduction for this project is determined as follows:

$$ER_y = (MD_{project, y} - MD_{reg, y}) \times GWP_{CH4} + EL_y \times CEF_{electricity, y} - ET_y \times CEF_{thermal, y} \quad 1)$$

$$MD_{project, y} = MD_{flared, y} + MD_{electricity, y} + MD_{thermal, y} \quad 2)$$

$$MD_{electricity, y} = LFG_{electricity, y} \times \omega_{CH4, y} \times D_{CH4} \quad 3)$$

$$MD_{flared, y} = (LFG_{flared, y} \times \omega_{CH4, y} \times D_{CH4}) - (PE_{flare, y} / GWP_{CH4}) \quad 4)$$

$$PE_{flare, y} = \sum TM_{RG, h} \times (1 - \eta_{flare, h}) \times GWP_{CH4} / 1000 \quad 5)$$

$$TM_{RG, h} = FV_{RG, h} \times fv_{CH4, RG, h} \times \rho_{CH4, n} \quad 6)$$

$$EL_y = EL_{EX, LFG, y} - EL_{IMP} \quad 7)$$



In the above formula, $LFG_{electricity, y}$ and $\omega_{CH_4, y}$ have been aggregated and reported. The value of D_{CH_4} is under standard temperature and air pressure (1.013bar and 0°C) ($\rho_{CH_4, n}$) is 0.0007168tCH₄/m³CH₄. No LFG was combusted in the flare and PP doesn't claim the CERs caused by flaring during this monitoring period, $MD_{flared, y}$ is zero. $MD_{thermal, y}$ and ET_y are zero as well.

The verification team cross-checked the reading records of the meters^{/10/}, monthly balance sheets^{/17/}, sales receipts^{/19/} and the daily log books, confirms that appropriate methods and formulae for calculation baseline emissions, project emissions and leakage have been followed, the readings of the meters are consistent with the related records and the daily log books.

The total emission reductions have been confirmed as follows:

Parameter	Reported value	Verified value
$MD_{project, y}$	3,258.3339 t CH ₄	3,258.3339 t CH ₄
$MD_{reg, y}$	0	0
$EL_{EX, LFG}$	15,062MWh	15,062MWh
EL_{IMP}	520.706MWh	520.706MWh

Thus total emission reductions achieved in this monitoring period is calculated as follows:

$$\begin{aligned}
 ER_y &= (MD_{project, y} - MD_{reg, y}) \times GWP_{CH_4} + EL_y \times CEF_{electricity, y} \\
 &= (3,258.3339 - 0) \text{tCH}_4 \times 21 \text{tCO}_2\text{e/tCH}_4 + (15,062 - 520.706) \text{MWh} \times 1.0303 \\
 &\quad \text{tCO}_2\text{e/MWh} \\
 &= \mathbf{83,407 \text{ tCO}_2\text{e}}
 \end{aligned}$$

CAR02 was raised during this verification as CQC team found the monthly values of EL_{IMP} at Jul. Aug. Oct. and Nov. of 2012 in the ER calculation spreadsheet version 01 were inconsistent with the sales receipts. This CAR was successfully closed out by PP during this verification. (Ref. Appendix A: CDM Verification Protocol - Table 2).

The verified emission reductions during this monitoring period is **83,407 tCO₂e** while the ex-ante estimated emission reductions for the same period is 157,639 tCO₂e based on the registered PDD. So the actual ERs are much less than the estimated emission reductions.

As per the requirements of VVS (Version 03.0), CQC verification team confirms the following information:

- The reported ERs during this monitoring period are 83,407 tCO₂e;
- The parameters were measured and monitored correctly by the PP and the operational and measurement equipments were well maintained and calibrated;
- The recorded values were cross-checked with the daily operational records, meter readings and electricity balance bills;



- The formulas and emission factors used in baseline emissions, project emissions and leakage were consistent with the registered PDD and the applied methodologies.

APPENDIX A: CDM VERIFICATION PROTOCOL

Table 1 verification checklist for Clean Development Mechanism (CDM) Project Activities

(MoV =Means of Verification, DR=Document Review, I=Interview)

Verification checklists	Ref	Mo v	Verification findings	Draft. Concl.	Final Concl.
1. COMPLIANCE OF THE PROJECT IMPLEMENTATION WITH THE REGISTERED PDD					
1.1 The detailed information on the site(s) of the project being implemented and starting date of operation for each site	PDD /6/ /7/	I DR Visit	The project – Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation is located at Shuangkou Landfill, Tianjin Municipality, China. The project was registered on 27/08/2008, with a reference number of 1406; and this is 4 th verification and the monitoring period covers from 01/01/2012 to 31/12/2012.	OK	OK
1.2 For CDM project activities with phased implementation, describe the progress of the proposed CDM project activity achieved in the each phase under verification. If the phased implementation is delayed, whether the reasons and the expected implementation date are described clearly and relevant evidence provided?	/6/ /9/	I DR Visit	The project is phased implementation. A gas collection system, a gas pretreatment system, an enclosed flare system and 2 CAT generator units and their appendix have been installed on-site. As the quantity of landfill gas was not enough for 3 generator units during this proposed monitoring period, the 3 rd generator unit was not installed during this monitoring period and planned to be installed based on the quantity of landfill gas during this crediting period and 1 more to be installed during the 2 nd crediting period. While as per the registered IRR calculation spreadsheet up to	CAR01	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl	Final Concl.
			<p>4 generators with 1250 kW capacity (manufactured by Deutz, according to the PDD) will be implemented during the 1st crediting period, while the monitoring report stated, on Section B.1, that two units with 1.03 MW capacity each (manufactured by CAT) were in operation during the monitoring period. With respect to this issue CAR01 was raised during this verification.</p> <p>The PP signed the <i>Grid connected agreement</i> in Oct. 2010 and two <i>Power Purchasing Agreement</i> with the local grid company in April 2011 and May 2012 respectively. The valid periods of these documents can cover this monitoring period. The installed generator has generated electricity power and supplied to Northern China Power Grid (NCPG). This has been confirmed by CQC verification team during the on-site visit.</p> <p>The measurement equipments are installed on-site, which is shown in the MR. All these equipments are calibrated by accredited third-party entity in accordance with Chinese national standards within this monitoring period.</p>	.	
1.3 Are all physical features of the proposed CDM project activity, proposed in the registered PDD, in place? (the detailed information on title, specification, installation time and operation status of the equipments installed)	/6/ /9/	I DR Visit	The project is phased implementation. The project expected to install 4 generators and an enclosed torch system on-site; the torch system and 2 generators	OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl	Final Concl.
			were installed on-site in this monitoring period.		
1.4 Is there any information (data and variables) provided in the MR that is different from that stated in the registered PDD? If so, - Has it caused an increase in estimates of the emission reductions in the current monitoring period? - Is it highly likely to increase the estimates of emission reductions in the future monitoring periods?	/6/ /2/ /3/ /4/	DR	No, all the data and variables provided in the MR are consistent with the registered PDD and the revised MP.	OK	OK
1.5 Are there any deviation or the proposed or actual changes in the implementation or operation of the project activity complied with the requirements of the Project Standard?	/5/ /29/	I DR	No.	OK	OK
1.6 Has the CDM project activity been implemented and operated as per the registered PDD?	/5/ /29/	I DR	As per the MR, the project activity has been implemented and operated as per the revised MP and the registered PDD.	OK	OK
2. COMPLIANCE OF THE MONITORING PLAN WITH THE MONITORING METHODOLOGY INCLUDING APPLICABLE TOOL(S)					
2.1 Which approved monitoring methodology has been applied by the project?	/2/ /3/ /4/	I DR	The approved consolidated monitoring methodology ACM0001 "Consolidated monitoring methodology for landfill gas project activities" (version 05) is applied to the project and the approved small-scale methodology AMS-I.D "Grid connected electricity generation from renewable sources" (version 10) is used for the energy displacement component.	OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl	Final Concl.
2.2 Is the monitoring plan of the project activity in accordance with the applied methodology including applicable tool (s)?	/2//3//4/5/	I DR Visit	Yes. The revised monitoring plan in accordance with the methodologies ACM0001 (version 05) and AMS-I.D (Version 10) has been applied by the CDM project activity.	OK	OK
2.3 Is the project implementation in accordance with the provisions of the registered PDD and/ or an approved revised PDD?	/5/ /6/	I DR	The project implementation in accordance with the provisions of the registered PDD and revised MP.	OK	OK
2.4 Are there any 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)? If yes, will CQC bring to the attention of the Board issues to enhance the level of accuracy and completeness of the monitoring plan?	/5//6/	I DR Visit	No.	OK	OK
3. COMPLIANCE OF MONITORING ACTIVITIES WITH THE REGISTERED MONITORING PLAN					
3.1 management system of Monitoring					
3.1.1 Have the project operator established management and operational system for the monitoring?	/7/	I DR Visit	Yes. PP has established management and operational system for the monitoring which is described in the OPERATIONS MONITORING PLAN (June 17, 2008).	OK	OK
3.1.2 Are the responsibilities and authorities for monitoring and reporting in accordance with the responsibilities and authorities stated in the monitoring plan?	/7/	I DR Visit	OPERATIONS MONITORING PLAN describes the responsibilities of PP CDM Leading Management: Periodic review of all the relevant documents; Monthly meeting and site auditing	OK	OK



Verification checklists	Ref	Mov	Verification findings	Draft. Concl.	Final Concl.
			<p>Strategic decisions making;</p> <p>CDM Project Manager & CDM Chief Engineer: Database Design; Establishment of CDM management team; Data Management System Design; Monthly Reports Sign-off;</p> <p>Training courses planning and organization; Regular reporting to the senior management of Longterm Enviro, TCEEE, and the World Bank</p> <p>CDM Site Manager: Hourly, Daily and Monthly reports sign-off; Identify abnormality and organize equipment repairing and maintenance; Organization of the third party equipment inspection</p> <p>CDM Site Engineer: Monitoring hourly data capturing; Sign off Hourly, Daily, and Monthly Reports; Complete Daily Operation Worksheets (on an hourly basis); Identify abnormality and report to the Site Manager; Burn Data CDs on a monthly basis Regular examination and maintenance of equipments.</p> <p>Through on-site visit and document review, CQC verification team has confirmed that all the above responsibilities are in accordance with those in actual operation.</p>		
3.1.3 Is the equipment used for monitoring controlled and calibrated in accordance with the monitoring plan, the applied methodology, the Board guidance, local/national standards, or as per the manufacturer's specification?	/8/11/12/1 3/15/16/1 8/20/21/2 2/23/24/2	I DR Visit	<p>Yes.</p> <p>The calibration and maintenance specifications of the equipments appropriate and PP has calibrated and maintained the equipments as per related</p>	OK	OK



Verification checklists	Ref	Mov	Verification findings	Draft. Concl.	Final Concl.																																	
	6		<p>specifications. See Appendix D for the detailed information.</p> <p>According to calibration reports, the valid period of the verification and calibration certificates covers the monitoring period.</p>	.																																		
3.1.4 Are monitoring results consistently recorded as per approved frequency?	/26/	I DR Visit	<p>Yes.</p> <p>All of the monitoring results consistently recorded as per approved frequency. The detailed information is as follow:</p> <table><tr><th>Parameter</th><th>Monitoring/recording frequency</th><th>Required frequency</th></tr><tr><td>$LFG_{total,y}$</td><td>Continuously/ Every minute</td><td>Continuously/ Monthly aggregation</td></tr><tr><td>$LFG_{electricity,y}$</td><td>Continuously/ Every minute</td><td>Continuously/ Every minute</td></tr><tr><td>$LFG_{flare,y}$</td><td>Continuously/ Every minute</td><td>Continuously/ Monthly aggregation</td></tr><tr><td>$\omega_{CH4,y}$</td><td>Continuously/ Every minute</td><td>Continuously</td></tr><tr><td>$FV_{RG,h}$</td><td>Same as $LFG_{total,y}$</td><td>Continuously/ Averaged hourly or at a shorter time</td></tr><tr><td>$fv_{i,h}$</td><td>/</td><td>/</td></tr><tr><td>$EL_{EX,LFG}$</td><td>Continuously /Monthly</td><td>Continuously / Monthly</td></tr><tr><td>EL_{IMP}</td><td>Continuously /Monthly</td><td>Continuously/ Recorded daily</td></tr><tr><td>Annual operation hours</td><td>Continuously /yearly</td><td>Continuously /yearly</td></tr><tr><td>P</td><td>Continuously/ Every minute</td><td>Continuously/ Recorded hourly</td></tr></table>	Parameter	Monitoring/recording frequency	Required frequency	$LFG_{total,y}$	Continuously/ Every minute	Continuously/ Monthly aggregation	$LFG_{electricity,y}$	Continuously/ Every minute	Continuously/ Every minute	$LFG_{flare,y}$	Continuously/ Every minute	Continuously/ Monthly aggregation	$\omega_{CH4,y}$	Continuously/ Every minute	Continuously	$FV_{RG,h}$	Same as $LFG_{total,y}$	Continuously/ Averaged hourly or at a shorter time	$fv_{i,h}$	/	/	$EL_{EX,LFG}$	Continuously /Monthly	Continuously / Monthly	EL_{IMP}	Continuously /Monthly	Continuously/ Recorded daily	Annual operation hours	Continuously /yearly	Continuously /yearly	P	Continuously/ Every minute	Continuously/ Recorded hourly	OK	OK
Parameter	Monitoring/recording frequency	Required frequency																																				
$LFG_{total,y}$	Continuously/ Every minute	Continuously/ Monthly aggregation																																				
$LFG_{electricity,y}$	Continuously/ Every minute	Continuously/ Every minute																																				
$LFG_{flare,y}$	Continuously/ Every minute	Continuously/ Monthly aggregation																																				
$\omega_{CH4,y}$	Continuously/ Every minute	Continuously																																				
$FV_{RG,h}$	Same as $LFG_{total,y}$	Continuously/ Averaged hourly or at a shorter time																																				
$fv_{i,h}$	/	/																																				
$EL_{EX,LFG}$	Continuously /Monthly	Continuously / Monthly																																				
EL_{IMP}	Continuously /Monthly	Continuously/ Recorded daily																																				
Annual operation hours	Continuously /yearly	Continuously /yearly																																				
P	Continuously/ Every minute	Continuously/ Recorded hourly																																				



Verification checklists	Ref	Mo v	Verification findings			Draft. Concl	Final Concl.
			$T_{total,y}$	Continuously/ Every minute	Continuously/ Recorded hourly		
			$PE_{flare,y}$	/	/		
			T_{flare}	Continuously/ Recorded hourly	Continuously/ Recorded hourly		
			laws and regulations	Yearly	Yearly		
3.1.5 Have quality assurance and quality control procedures been applied in accordance with the monitoring plan or the revised monitoring plan?	/5 //7/	I DR Visit	Yes. The OPERATIONS MONITORING PLAN has been documented and applied by PP in accordance with the monitoring plan.			OK	OK
3.2 implementation and quality control of monitoring							
3.2.1 Have the parameters for project emissions been monitored?	/2/3/4/	I DR Visit	See the discussion of section 3.4.1.1-3.4.1.14			OK	
3.2.2 Have the parameters for Baseline emission been monitored?	/2/3/4/	I DR Visit	See the discussion of section 3.4.1.1-3.4.1.14 While during this verification, it was found the parameter P was not included in the MR version 02(GSP version). CAR03 was raised and successfully closed out during this verification.			CAR03	OK
3.2.3 Have the parameters for Leakage emission been monitored?	/2/3/4/	I DR Visit	See the discussion of section 3.4.1.1-3.4.1.14			OK	OK
3.2.4 Has the actual monitoring been implemented in accordance with the monitoring plan contained in	/5/6/7/	I	All the parameters have been monitored in			OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl	Final Concl.
the registered PDD (or the accepted revised monitoring plan)?		DR Visit	accordance with the MP revision. The revised MP (in both clean and track versions) and a validation opinion from CQC verification team have been submitted to the UNFCCC secretariat for approval.		
4. COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS FOR MEASURING INSTRUMENTS					
4.1 Has the calibration been delayed and implemented after the monitoring period in consideration? If so, -whether the following conservative approach is adopted? (a) Applying the maximum permissible error 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 (b) Applying the error identified in the delayed calibration test, if the error is beyond the maximum permissible error of the measuring equipment.	PDD MR /26/	DR, I	The calibration of the monitoring equipments has not been delayed.	OK	OK
4.2 Are the results of the delayed calibration not available, or the calibration not been conducted at the time of verification?	PDD MR /26/	DR, I	The calibration of the monitoring equipments has not been delayed.	OK	OK
4.3 Is it necessary to request any post registration change (the requested calibration is impossible to PP)?	PDD MR /26/	DR, I	No.	OK	OK
4.4 Whether the equipments are calibrated either in	PDD	DR,	The equipments are calibrated in accordance with the	OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl.	Final Concl.
accordance with the specification of the local/national standards, or as per the manufacturer's specification? If not, whether the international standards are used?	MR /26/	I	revised monitoring plan.		
5. ASSESSMENT OF DATA AND CALCULATION OF EMISSION REDUCTIONS					
5.1 Is a complete set of data for the specified monitoring period available?	/10/	I DR Visit	Yes. A completed set of data which can cover the monitoring period of this monitoring report have been provided to the verification team.	OK	OK
5.2 Is there any data not available because activity levels or non-activity parameters have not been monitored in accordance with the registered monitoring plan? If so, - How to make the most conservative assumption? - Is it necessary to raise a CAR or request for deviation from the MP?	/10/	DR, I	No. All of the parameters have been measured and are available.	OK	OK
5.3 Have the reported data been cross-checked with other sources such as plant log books, inventories, purchase records, laboratory analysis? Especially, has an attention been paid to completeness and reasonableness of records in, for example, a daily operation log.	/14/17/19/ 27/	DR, I	Yes. The monitoring report is cross-checked with work logs, the receipts from the grid company, measurement equipments calibration records, and monitored parameters records. While during the verification, it was found that the monthly values of EL_{IMP} at Jul. Aug. Oct. and Nov. of 2012 in the ER calculation spreadsheet version 01 were inconsistent with the sales receipts. With respect to this issue CAR02 was raised during this verification.	CAR02	OK
5.4 Have the calculations of baseline emissions, project emissions and leakage been carried out	/6/10/	DR,	Yes. The calculations of baseline emissions, project	OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl	Final Concl.
in accordance with the formulae and methods described in the monitoring plan and the applied methodology document?		I	emissions have been carried out in accordance with the formula and methods described in the monitoring plan and then applied methodology document. The leakage emission is 0.		
5.5 Has any assumption used in emission calculations been justified?	/6/10/27/	DR, I	There are no any assumptions in emission calculations.	OK	OK
5.6 Have appropriate emission factors and default values been correctly applied?	/5/6/10/	DR	The emission factor of electricity (CEF _{electricity}), which was determined ex-ante and was fixed as 1.0303 tCO ₂ /MWh. Methane density and GWP _{CH4} are applied correctly.	OK	OK
5.7 Has a comparison of actual GHG emission reductions of the project activity achieved during this monitoring period with the estimates in the registered PDD been provided?	PDD MR	DR	Yes It was been carried out at Section E.5 in MR.	OK	OK
5.8 If there is an increase in the actual GHG emission reductions achieved during this monitoring period, has the cause of such increase been explained?	PDD MR	DR	No. The actual GHG emission reductions far less than the estimated values.	OK	OK
6. POST REGISTRATION CHANGES					
6.1 TEMPORARY DEVIATIONS FROM THE REGISTERED MONITORING PLAN AND/OR APPLIED METHODOLOGY					
6.1.1 If the parameters related to the baseline GHG emission have temporarily not monitored or the related evidences are not provided, are these parameters reported as zero in the MR?	PDD MR	DR	N.A	OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl.	Final Concl.
6.1.2 If the parameters related to the baseline GHG emission have temporarily not monitored or the related evidences are not provided, are these parameters reported as zero in the MR?	PDD MR	DR	N.A	OK	OK
6.1.3 In the case of project GHG emissions related to the consumption of electricity, does the estimate include an addition of 10% to account for transmission and distribution losses.	PDD MR	DR	N.A	OK	OK
6.2 Correction					
6.2.1 Does the correction to the project information affect the design of the project activity?	PDD MR	DR	N.A	OK	OK
6.3 Changes to the start date of the crediting period					
Does the PP wish to change of the start date of the crediting period? If so, whether the proposed changes result in a less conservative baseline?	PDD MR	DR	N.A	OK	OK
6.4 Permanent changes from the registered monitoring plan or monitoring methodology					
6.4.1 Is the accuracy level of the monitoring equipment actually installed and controlled by the PP lower than the one stipulated in the applied methodology and/or in the registered monitoring plan?	PDD MR	DR	N.A	OK	OK
6.4.1.1 If the parameter is used for calculating baseline GHG emissions, has the difference between the accuracy level of the installed monitoring equipment and the accuracy prescribed by the applied methodology and/or the registered monitoring plan been deducted	PDD MR	DR	N/A. The accuracy of all meters is in line with the requirements of the registered PDD and the revised MP.	OK	OK



Verification checklists	Ref	Mo v	Verification findings	Draft. Concl	Final Concl.
from the measured value?					
6.4.1.2 If the parameter is used for calculating project GHG emissions, has the difference between the accuracy level of the installed monitoring equipment and the accuracy prescribed by the applied methodology and/or the registered monitoring plan been added to the measured value?	PDD MR	DR	N/A	OK	OK
6.4.2 Does the change to the monitoring of the registered CDM project activity belong to a type listed below: (a) Change of calibration frequency or practice for monitoring equipment not within the control of project participants; (b) Change of accuracy/type/model of meter(s) as per a power purchase agreement (PPA); (c) Change of location of meter(s) as per a power purchase agreement (PPA).	PDD MR	DR	Yes. It is necessary to request PP for revision of MP. The revised MP and the validation opinion report for this MP revision were submitted to the UNFCCC secretariat and approved on 01/07/2011.	OK	OK
6.5 Changes to the project design of a registered project activity					
6.5.1 Does the change adversely impact the project design in any of the following way: (a) The applicability and application of the applied methodology under which the project activity has been registered; (b) The additionality of the project activity; (c) The scale of the project activity.	PDD MR	DR	As per the registered IRR calculation spreadsheet up to 4 generators with 1250 kW capacity (manufactured by Deutz, according to the PDD) will be implemented during the 1 st crediting period, while the final monitoring report stated, on Section B.1, that two units with 1.03 MW capacity each (manufactured by CAT) were in operation during the monitoring period. With respect to this issue CAR01 was raised during this verification.	CAR01	OK

Table 2 Resolution of Corrective Action and Clarifications

Draft report clarifications and corrective action requests by verification team	Ref. to checklist question in table 2	Summary of project owner response	Verification conclusion
Corrective Action Requests (CARs)			
<p>CAR01</p> <p>As per the registered IRR calculation spreadsheet up to 4 generators with 1250 kW capacity (manufactured by Deutz, according to the PDD) will be implemented during the 1st crediting period, while the final monitoring report stated, on Section B.1, that two units with 1.03 MW capacity each (manufactured by CAT) were in operation during the monitoring period.</p>	1.2, 6.5	<p>As per the registered PDD up to 4 generators were recommended for installation under the FSR based on the estimated availability of gas for energy generation. As has been documented on the 3 previous monitoring reports, the reality is that gas availability has been lower due to a variety of reasons (including ability of gas extraction, learning process with the technology, climatic conditions at the site, to name a few, please refer to previous monitoring reports for further details). This has had an impact on less CER revenues, less energy revenues, and hence implications on delay for further implementation of energy generators. Therefore, the current installation of two units of CAT3516 generators has taken into account the lower-than-estimated amount of Landfill Gas that has been generated on the ground. Since there was concern at the construction stage that there would not be sufficient quantity of LFG to be fed into four power generators in early years of operation, to be financially efficient, project owner decided to install two units of power generators during the first five years of operation, with option open to adding on two</p>	<p>OK.</p> <p>Based on the onsite visit and the generators purchase contracts, it was confirmed by CQC team that 2 CAT generators with 1.03 MW capacity each were well installed in the project site. As per the FSR 4 generators continue to be envisaged for the project activity, and that installation has been delayed due to lower collection/availability of gas as documented on previous monitoring reports, therefore not constituting a project change as project design continues to be the same as far as the number of generators to be installed.</p> <p>CQC has also checked the FSR and confirms that both CAT and Deutz generators are recommended in the FSR and based on the estimated landfill gas availability, the gradual installation generators, up to 4, is recommended.</p> <p>The suggested generators in the FSR^{/36/},</p>



Draft report clarifications and corrective action requests by verification team	Ref. to checklist question in table 2	Summary of project owner response	Verification conclusion
		<p>more units in 2013 and 2018 respectively when gas generation catches up. The actual generation records prove that the performance of the project has not yet reached the estimated level in PDD (see table 3 below). Having said that, the project has improved on all fronts and continues to expect the implementation of the 4 generators as envisioned by the project design on the FSR. Hence delay in project implementation does not imply change of project design.</p> <p>As for the change on the first two generators installed at the site, it can be seen that two types of power generators, CAT3516 1.03MW per unit and Deutz 1250KW per unit, were recommended in the project Feasibility Study that was completed in November 2006. IRR calculation at the time of project validation was carried out with reference to Deutz 1250KW according to the recommendation at project investment decision time in July 2007. The selection of CAT3516 1.03MW instead of Deutz 1250KW was based on the following factor:</p> <p>Availability of generator supply at the time of project procurement. During project procurement period in 2008, Project entity was informed that DEUTZ generators were out of stock and the earliest available time would be 9 months after the order was placed. Considering that the similarity in technical</p>	<p>CAT3516 and Deutz TBG 620V16K, are similar with each other, has internal-combustion engine with 16 cylinders. The information of Deutz generators is used in the registered PDD and IRR calculation spreadsheet.</p> <p>While then the project was constructed, it was informed by Deutz that Deutz was out of stock, it would take more than 9 months to order a Deutz 1250kW generator. The project owner couldn't wait so long and decided to purchased CAT3516 (capacity 1.03MW) instead. For the management and operation convenience of generators, the second generators was also adopted as CAT3516. When the LFG captured can meet more generators, this project is designed to install 4 generators.</p> <p>As per para.270 of VVS 03.0 and the relevant provisions of appendix 1 of the Project standard, CQC team confirms that the actual changes to the project design of a registered CDM project activity that do not adversely impact any of the following do not require prior approval by the Board. The verification is listed below:</p> <p><i>(a)The applicability and application of the applied methodology under which the project</i></p>



Draft report clarifications and corrective action requests by verification team	Ref. to checklist question in table 2	Summary of project owner response	Verification conclusion
		<p>specifications of the two models, both of which have internal-combustion engine with 16 cylinders and both models were recommended in the project feasibility study, CAT3516 was selected in order to keep up the pace of project construction. The timeline of the project implementation is as follows:</p> <p>November 2006: Project Feasibility Study completed. Two types of power generators were considered in the study : CAT3516 and Deutz TBG620</p> <p>July 13 2007: Project investment decision. (Deutz generator was chosen in the investment decision)</p> <p>November 14 2007: Project procurement completed (CAT generator was selected)</p> <p>January 23 2008: project construction started</p> <p>May 27 2008: Project commissioning started (1# generator)</p> <p>August 27 2008: CDM project registered</p> <p>November 17 2010: Project commissioning starts (2# generator)</p> <p>The selection of CAT generators would slightly decrease the IRR compared to the selection of Deutz, due to the smaller capacity of generators of the actual installed capacity of the CAT UNIT (1.03MW/unit) than the designed capacity of 1.25MW/unit, which would</p>	<p>activity has been registered;</p> <p>It was confirmed by CQC team that the Deutz generator in the PDD was replaced by similar CAT generator, which has no influence on the applicability and application of the applied methodology ACM0001 (version 05.0) under which the project activity has been registered.</p> <p>(b) The additionality of the project activity;</p> <p>As per the registered PDD, the additionality of the project activity is demonstrated by investment a analysis and benchmark analysis method was applied. The calculated IRR value of the project without CERs would be 5.87% in the registered PDD, below the adopted benchmark rate 8%. Thus without CERs revenue, it is evident that this project faces substantial financial hurdles and would not be implemented.</p> <p>As per para.223 of CDM PS version 03.0, <i>in cases where the proposed or actual changes affect the additionality of the registered CDM project activity, as referred to in paragraph 222(d) above, the demonstration of the impacts of changes shall be based on all original input data. In addition:</i></p> <p><i>(a) In the case of investment analysis,</i></p>



Draft report clarifications and corrective action requests by verification team	Ref. to checklist question in table 2	Summary of project owner response	Verification conclusion
		<p>imply that the change of generator would not improve the economic performance and the project would continue not to be attractive for investment.</p> <p>IRR analysis has been updated to reflect the change in power generators and IRR has further decreased to 2.26% (without CER) under the assumption of 2 additional units of CAT3516 1.03MW power generators to be installed during project lifetime. Therefore it is proven that the project remains additional. Changes are made on the following parameters only:</p> <ol style="list-style-type: none"> (1) Capital investment: actually purchasing price of CAT power generators; (2) Annual repair cost: adopting original calculating method, value is from (TOTAL FIXED ASSETS)*7%; (3) Electricity exported to grid: it is calculated based on the same formula as in the registered PDD: capacity x 8000 hours x 95%, in which a downward adjustment will be made in first year when generator newly installed and in the last year when generator will be removed accordingly, calculating method and downward percentage being same with original table. <p>Price breakdown of CAT3516 generator (10,000 RMB) based on the actual contracts:</p>	<p><i>project participants shall only modify the key parameters in the original spreadsheet calculations affected by the proposed or actual modifications to the project activity.</i></p> <p>The PP recalculated the IRR value of this project under the assumption of 2 additional units of CAT3516 1.03MW power generators to be installed during project lifetime. The values of the CAT generator purchase contracts^{/37/}, the adjusted delivered electricity to the grid and OM cost were used. Other parameters in the registered IRR spreadsheet remain unchanged.</p> <p>PP supplied the CAT generator purchase contracts to CQC team and the total value is 5.355 million RMB and related contracts^{/37/} are supplied to CQC. The delivered electricity to the grid for is calculated as: installed capacity times annual operational hours (8000h) minus 5% auxiliary power, in which a downward adjustment due to the capacity change is made in first year when generator newly installed and in the last year when generator will be removed accordingly, calculating method and downward percentage being same with the registered IRR calculation spreadsheet. As to the O&M cost, the repair fee calculation is still the same as Deutz, which is 7% of total fixed assets. CQC team confirms the changes of the input values in IRR</p>



Draft report clarifications and corrective action requests by verification team	Ref. to checklist question in table 2	Summary of project owner response	Verification conclusion
		<p>Cat engine only after tax: 410</p> <p>Air-fuel ratio controller: 20.9</p> <p>Paralleling switchgear: 57.1</p> <p>Sound-proof box: 25</p> <p>Water tank radiator: 22.5</p> <p>Total: 535.5</p>	<p>calculation are reasonable.</p> <p>The re-calculated IRR value without CERs is 2.26%, which is less than the IRR value 5.87% in the registered PDD and far below the adopted benchmark rate 8%.</p> <p>Moreover, CQC team also recalculates another possible scenario: the final installation is 2 units of CAT 1.03MW generators and 2 units of Deutz 1.25MW generators. The IRR would be 3.50%, which is still far below the benchmark rate 8%.</p> <p>The detail calculation can be seen in the attached adjusted IRR calculation spreadsheets. So CQC team confirms this change has no adversely impact on the additionality of the project activity.</p> <p>(c) The scale of the project activity.</p> <p>As per the registered PDD, the total capacity of this project is 5MW (1.25MWX4units). The actual installed capacity is 2.06MW (1.03MWX2units) up to now and the expected total capacity is 4.12MW (1.03MWX4units) or 4.56MW (1.03MWX2units+1.25MWX2units). As 5MW, 4.56MW and 4.12MW are less than 15MW, the threshold of microscale project activities. Moreover, as per the registered PDD, Large scale methodology ACM0001 ver.05 was applied by this project. So CQC team confirms this change has no</p>



Draft report clarifications and corrective action requests by verification team	Ref. to checklist question in table 2	Summary of project owner response	Verification conclusion
			adversely impact on the scale of the project activity. So CAR01 is closed out.
CAR02 CQC team cross checked this parameter with sales receipts which were issued by local State Grid company and found the monthly values of EL_{IMP} at Jul. Aug. Oct. and Nov. of 2012 in the ER calculation spreadsheet version 01 were inconsistent with the sales receipts.	5.3	The values have been corrected accordingly in the ER calculation spreadsheet version 02.	OK. CQC team has carefully checked the values mentioned in this CAR in the final ER calculation spreadsheet with the sales receipts and confirm they are consistent with each other. So CAR02 is closed out.
CAR03 The parameter P was not included in section D.2 Data and parameters monitored of the MR version 02 (the GSP version).	3.3.2	The parameter P is included in proper position of final MR. The parameter P missing in MR version 02 is due to a wrong operation.	OK. The description on monitoring of parameter P was added in the revised MR, which is fully consistent with the MP and real monitoring process. So CAR03 is closed out.



Table 3 The comparison of actual generation of the project and the estimated level in PDD

	LFG total (Nm3)			LFGel (Nm3)			Electricity (MWh)		
	PDD	Actual	Actual/PDD	PDD	Actual	Actual/PDD	PDD	Actual	Actual/PDD
2008	2,861,255	1,137,558	39.8%	2,610,405	1,122,337	42.99%	3,724	2,045	54.92%
2009	9,733,307	3,670,255	37.7%	6,660,000	3,627,381	54.47%	9,500	6,441	67.8%
2010	12,161,345	4,016,426	33%	6,660,000	3,991,925	59.94%	9,500	7,402	77.91%
2011	15,431,166	6,633,663	43%	13,320,000	6,609,203	49.62%	19,000	11,146	58.66%
2012	18,902,136	7,729,873	40.9%	13,320,000	7,756,648	58.23%	19,000	14,541	76.53%



APPENDIX B: CERTIFICATE OF COMPETENCE



CERTIFICATE OF COMPETENCE

Qualification in accordance with CQC's procedure for Qualifications and Training Management (CDMP01):

Name: Dong Chunsong
CDM validator: Yes
CDM verifier: Yes
Technical expert: /
Technical areas: TA1.2:Energy generation from renewable energy sources
TA13.1: Waste handling and disposal

Approved by:
(Quality manager)

Date: 2011-03-17



CERTIFICATE OF COMPETENCE

Qualification in accordance with CQC's procedure for Qualifications and Training Management (CDMP01):

Name: Nie Xi
CDM validator: Yes
CDM verifier: Yes
Technical expert: /
Technical area: TA13.1: Waste handling and disposal
TA1.2:Energy generation from renewable energy sources

Approved by:
(Quality manager)

Date: 2011-11-18



CERTIFICATE OF COMPETENCE

Qualification in accordance with CQC's procedure for Qualifications and Training Management (CDMP01):

Name: Wang Keli
CDM validator: Yes
CDM verifier: Yes
Technical expert: /
Technical area: TA1.2:Energy generation from renewable energy sources
TA13.1: Waste handling and disposal
TA 13.2/TA15.2: Animal waste management

Approved by:
(Quality manager)

Date: 2011-07-11



CERTIFICATE OF COMPETENCE

Qualification in accordance with CQC's procedure for Qualifications and Training Management (CDMP01):

Name: Wang Zhenyang
CDM validator: Yes
CDM verifier: Yes
Technical expert: /
Technical areas: TA1.2:Energy generation from renewable energy sources
TA 8.1: Mining and mineral processes, excluding those included in TA 8.2
TA 10.1: Mining and mineral processes, excluding those included in TA 10.2

Approved by:
(Quality manager)

Date: 2011-03-17

APPENDIX C: REFERENCE LIST

Reference code	Document
/1/	CDM Validation and verification standard, version 03.0
/2/	AMS-I.D. – Grid connected renewable electricity generation , version 10
/3/	ACM0001 – Consolidated baseline and monitoring methodology for landfill gas project activities, version 5
/4/	Tool to determine project emissions from flaring gases containing methane, version 1
/5/	Registered PDD of Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation Project (version 7 dated 06/12/2007)
/6/	Monitoring Report for Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation Project, version 01, 06/03/2013
/7/	Operations Monitoring Plan (Manual of CDM monitoring system)
/8/	Specification of flow meter installed on the main pipe
/9/	<ul style="list-style-type: none"> Quality supervision and inspection report for the whole Power generation set after trial run issued by Tianjin Xinyuan Electric power construction engineering quality supervision station on 05/06/2008; Supervision Summary issued by the first subsidiary of Tianjin Electric Power Engineering supervision Co., Ltd., on 05/07/2008.
/10/	CDM daily report sheet
/11/	Specification of flow meter installed on the power plant pipe
/12/	Specification of flow meter installed on the flare pipe
/13/	Specification of methane fraction meter installed on the main pipe
/14/	GEM2000 Range Gas Analysers Operating Manual
/15/	Specification of methane fraction meter installed on the flare pipe
/16/	Specification of the electricity meter (to the grid, including main and back up)
/17/	Monthly balance sheet issued by Tianjin Grid company
/18/	Specification of the electricity meter (from the grid)
/19/	Sales receipt of electricity purchase issued by Tianjin Grid company
/20/	Specification of hour meter
/21/	Specification of pressure meter
/22/	Specification of temperature meter
/23/	Specification of flare
/24/	Specification of Type N thermometer
/25/	Standard for pollution control on the landfill site of municipal solid waste (GB16889-2008)
/26/	Calibration reports of monitoring equipments
/27/	Grid connected agreement (Oct. 2010) Power purchase agreements (April 2011 & May 2012)



/28/	Verification report, version 02, by CQC, 02/08/2010 and Certification report, by CQC, 03/08/2010 for the 1 st periodic monitoring period Verification report, version 02, by CQC, 05/09/2011 and Certification report, by CQC, 15/09/2011 for the 2 nd periodic monitoring period Verification report, version 02, by CQC, 22/08/2012 and Certification report, by CQC, 22/08/2012 for the 3 rd periodic monitoring period
/29/	Revised monitoring plan, approved on 01/07/2011
/30/	Validation opinion on the revised monitoring plan, 18/02/2011
/31/	Internal audit reports (June 2012 & December 2012)
/32/	Monitoring Report for Tianjin Shuangkou Landfill Gas Recovery and Electricity Generation Project, version 04, 16/07/2013
/33/	Daily working log books (01/01/2012 ~ 31/12/2012)
/34/	Clean Development Mechanism Project Standard (version 03.0)
/35/	Clean Development Mechanism Project Cycle Procedure, Ver.03.2
/36/	FSR report of this proposed project finished by Tianjin international engineering consulting company, Nov.2006
/37/	The CAT generator purchase contracts of this project.



APPENDIX D: MEASUREMENT EQUIPMENTS LIST*

In the host country China, the measurement equipments used for trade are required to take compulsively verification during the usage period according to *Metrology Law of the People's Republic of China* and *Rules for the Implementation of the Metrology Law of the People's Republic of China*. The measurement equipments of this project activity are in accordance with the requirements mentioned above. The equipments were verified by qualified labs and the detailed technical standards are listed in Appendix C as reference (reference /26/). CQC verification team confirms the verification certificates of the measurement equipments during the on-site visit.

Measured parameter	Equipments used in this monitoring period	Working period in this monitoring period	Calibration valid period	Calibration frequency requirement	Calibration entity
LFG_{total}	Vortex flow meter,model:LUGB150 SN: 08150C04; accuracy:1.5%	01/01/2012 ~ 05/03/2012	17/03/2011 ~ 16/03/2012	Annually	Wuxi Measurement Testing Center
	Vortex flow meter, model:LU150, SN: 10150G179; accuracy:1.5%	05/03/2012 ~ 31/12/2012	23/02/2012 ~ 22/02/2013	Annually	Wuxi Measurement Testing Center
LFG_{flare} or FV_{RG,h}	Vortex flow meter, model:LU100 SN: 8100C13; accuracy:1.5%	01/01/2012 ~ 11/07/2012	22/07/2011 ~ 21/07/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	Vortex flow meter, model:LUGB100 SN: 10100G178; accuracy:1.5%	11/07/2012 ~ 31/12/2012	23/02/2012 ~ 22/02/2013	Annually	Wuxi Measurement Testing Center
LFG_{electricity}	Vortex flow meter,model:LU100,SN: 08100C12; accuracy:1.5%	01/01/2012 ~ 05/03/2012	17/03/2011 ~ 16/03/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	Vortex flow meter,model:LUGB100,SN: 10100G178; accuracy:1.5%	05/03/2012 ~ 05/07/2012	23/02/2012 ~ 22/02/2013	Annually	Wuxi Measurement Testing Center

* Quite a few type errors in the table 1 of the MR vesion 02(GSP version) were identified and the identified type errors were corrected in the final MR.



	Vortex flow meter,model:LUGB:151, SN: V15025015; accuracy:1.5%	05/07/2012 ~ 31/12/2012	30/05/2012 ~ 29/05/2013	Annually	Hebei Province Institute of Metrological Supervision and Testing
T_{flare}	Type N thermocouple, #1-a, accuracy: class II	01/01/2012 ~ 01/08/2012	18/08/2011 ~ 17/08/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	Type N thermocouple, #2-a, accuracy: class II	01/01/2012 ~ 01/08/2012	18/08/2011 ~ 17/08/2012	Annually	
	Type N thermocouple, #3-a, accuracy: class II	01/01/2012 ~ 01/08/2012	18/08/2011 ~ 17/08/2012	Annually	
	Type N thermocouple, SN:12061646, accuracy: class II	01/08/2012 ~ 31/12/2012	25/07/2012 ~ 24/01/2013	Twice a year	
	Type N thermocouple, SN:12061647, accuracy: class II	01/08/2012 ~ 31/12/2012	25/07/2012 ~ 24/01/2013	Twice a year	
	Type N thermocouple, SN:12061648, accuracy: class II	01/08/2012 ~ 31/12/2012	25/07/2012 ~ 24/01/2013	Twice a year	
$w_{CH_4}/fv_{i,h}$	CH ₄ fraction meter, model: GASBOARD-3200, SN: 108032101061000000051; accuracy:2%	01/01/2012 ~ 08/02/2012 (flare pipe)	10/02/2011 ~ 09/02/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	CH ₄ fraction meter, model: GASBOARD-3200, SN: 11201060106100000019; accuracy:2%	08/02/2012 ~ 31/12/2012 (flare pipe)	31/01/2012 ~ 30/01/2013	Annually	Hubei Province Institute of Metrological Supervision and Testing



	CH ₄ fraction meter,model:GASBOARD-3200, SN: 09010809;accuracy:2%	01/01/2012 ~ 13/12/2012 (main)	19/12/2011 ~ 18/12/2012	Annually	Jiangsu Institute of Metrology
	CH ₄ fraction meter, model:GASBOARD-3200, SN: 108032101061000000051; accuracy:2%	13/12/2012 ~ 31/12/2012 (main)	08/11/2012 ~ 07/11/2013	Annually	Hubei Province Institute of Metrological Supervision and Testing
T	Temperature meter, JWB/T100, SN: K1111232; accuracy:0.5%	01/01/2012 ~ 05/07/2012	18/07/2011 ~ 17/07/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	Temperature meter, JWB/P251, SN: K80314; ; accuracy:0.5%	05/07/2012 ~ 31/12/2012	05/06/2012 ~ 04/06/2013	Annually	
P	Pressure meter, JYB-KB-PAG, SN: 08030359; accuracy:0.5%.	01/01/2012 ~ 05/07/2012	07/07/2011 ~ 06/07/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	Pressure meter, JYB-KB-PAG, SN: 08030358; accuracy:0.5%.	05/07/2012 ~ 31/12/2012	01/06/2012 ~ 31/05/2013	Annually	
EL_{EX, LFG}	Electricity energy meter,model:DSSD178, SN: L4J07600476621708, accuracy:0.5S.	01/01/2012 ~ 31/12/2012	17/10/2007~16/10/2012 05/07/2012~04/07/2017	Calibration is undertaken by the State Grid, as per State Grid Connection Requirements.	Tianjin Electric Power Corporation Electric Power Research Institute
EL_{IMP}	Electricity energy meter, model:DTSD178,SN:	01/01/2012 ~ 05/07/2012	13/05/2008~12/05/2013	The validity period is 5	



	N5Z08600564341708, accuracy:0.5S.			years.	
	Electricity energy meter, model:DTSD178, SN: 070764286942, accuracy:0.5S.	05/07/2012 ~ 31/12/2012	05/07/2012~04/07/2017		
Operating hours	Hour meter, model: JS/A-HBT1V1, SN: F201102110101 (Generator #1); accuracy:0.1%.	01/01/2012 ~ 04/05/2012	05/05/2011 ~ 04/05/2012	Annually	Tianjin Institute of Metrological Supervision and Testing
	Hour meter, model: JS/A-HBT1V1N, SN: E0907030201 (Generator #1); accuracy:0.1%.	04/05/2012 ~ 31/12/2012	04/05/2012 ~ 03/05/2013	Annually	
	Hour meter, model: JS/A-HBT1V1N, SN: E201005060201 (Generator #2); accuracy:0.1%.	01/01/2012 ~ 11/07/2012	13/07/2011 ~ 12/07/2012	Annually	
	Hour meter, model: JS/A-HBT1V1, SN: F201102110101 (Generator #2); accuracy:0.1%.	11/07/2012 ~ 31/12/2012	04/06/2012 ~ 03/06/2013	Annually	