

# Validation Report

Report for:

Daegu Metropolitan City

Validation of CDM project for  
Daegu Bangcheon-Ri Landfill gas CDM Project in  
Republic of Korea

LRQA Reference: LRQ CDM 0006 Version 02

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Work carried out by: Prabodha C. Acharya  
Byoung Un Heo  
Seung Hyun Kwak

Work verified by: Takahiro Iio  
Anne-Marie Warris

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## 1 Executive Summary

Lloyd's Register Quality Assurance Limited (LRQA) has been contracted by the project participant (PP) represented by Ecoeye Co., Ltd., to undertake validation of the proposed project activity "Daegu Bangcheon-Ri Landfill gas CDM project" in Republic of Korea. The validation has been performed by document review based on the project design document (PDD), follow-up interviews with the stakeholders and resolution of outstanding issues and issuance of the validation report.

The project intends to reduce greenhouse gas (GHG) emissions by implementation of capturing, refining and utilization of landfill gas (LFG) from the existing Bangcheon-Ri Landfill, Daegu city, Republic of Korea.

The fulfilment of the requirements as set forth in the Article 12 of the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC), the modalities and procedures for a clean development mechanism (CDM) under the Decision 17/CP.7 (CDM M&P) and relevant decisions of the Conference of the Parties serving as meeting of the Parties to the Kyoto Protocol (COP/MOP) and the executive board of the CDM (CDM-EB) has been evaluated and the conformance to the validation requirements were assessed based on the given information. A risk based approach was taken to conduct the validation and corrective action requests (CARs) and clarifications (CLs) were raised for relevant actions by the PP.

It is LRQA's opinion that the proposed project activity as detailed in the project design document, version 07 dated 15<sup>th</sup> May 2007 meets all relevant UNFCCC requirements for the CDM as well as the host country's national requirements. Therefore LRQA request the registration of "Daegu Bancheon-Ri Landfill gas CDM project" to the CDM Executive Board as a CDM project activity.

Lloyd's Register Quality Assurance Ltd  
Hiramford  
Middlemarch Office Village  
Siskin Drive  
Coventry CV3 4FJ  
United Kingdom

Registered office:  
Lloyd's Register  
71 Fenchurch Street  
London EC3M 4BS  
United Kingdom

## Abbreviations

AF	Adjustment factor
BM	Build margin
BTO	Build, transfer and operate
CARs	Corrective action requests
CDM	Clean Development Mechanism
CDM-AP	CDM Accreditation Panel
CDM-EB	Executive Board of Clean Development Mechanism
CDM M&P	Modalities and procedures for a clean development mechanism
CDM-MP	The methodologies Panel of Clean Development Mechanism
CEF	Carbon emission factor (CO <sub>2</sub> emissions intensity)
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CLs	Clarifications
CM	Combined margin
CO <sub>2</sub>	Carbon dioxides
COP/MOP	Conference of the Parties serving as meeting of the Parties to the Kyoto Protocol
DH	District heating
DNA	Designated National Authority
EIA	Environmental impacts assessment
ERs	Emission reductions
GHG / GHGs	Greenhouse gas, greenhouse gases
IPCC	Intergovernmental panel on climate change
IRR	Internal rate of return
KDHC	Korea District Heating Corporation
KP	Kyoto Protocol of the United Nations Framework Convention on Climate Change
kW	Kilowatt
LFG	Landfill gas
LNG	Liquefied natural gas
LoA	Letter of approval
LR	Lloyd's Register
LRQA	Lloyd's Register Quality Assurance Limited
MoE	The Ministry of Environment, the Republic of Korea
MSW	Municipal solid waste
MW / MWh	Megawatt, Megawatt hour
NGO	Non governmental organization
Nm <sup>3</sup>	Normal cubic meter
OM	Operating margin
OXID	Oxidation factor
PDD	Project design document
PP / PPs	Project participant, project participants
tCO <sub>2</sub>	Ton of carbon dioxides
UNFCCC	United Nations Framework Convention on Climate Change
US EPA	The United States Environmental Protection Agency

## 2 Introduction

The project participants (PPs) represented by Daegu Metropolitan City and Ecoeye Co., Ltd. have contracted with Lloyd's Register Quality Assurance Limited (LRQA) to undertake validation of the proposed project activity "Daegu Bangcheon-Ri Landfill gas CDM project" in Korea. This report summarises the findings through the validation process that has been conducted on the validation requirements of the CDM.

The validation has been undertaken by the team formed of the qualified personnel of LRQA as follows.

Mr. Prabodha C. Acharya	LRQA India	Team Leader, CDM Validator, Sector expert
Mr. Byong Un Heo	LRQA Korea	Team Member, CDM Validator
Mr. Seung Hyun Kwak	LRQA Korea	Team Member, CDM Validator
Mr. Takahiro Iio	LRQA Japan	Technical Reviewer, CDM Validator, sector expert
Dr. Anne-Marie Warris	LRQA Centre	Final Reviewer/Decision Maker

Personnel being engaged in this CDM project validation are qualified based on the established procedures of LRQA to assure the resource requirements that satisfy all the requirements of competence criteria for an AE/DOE under CDM CDM-ACCR-06. LRQA is accredited and designated as an operational entity and holds the full responsibility on decision-making regarding the validation in accordance with the accreditation requirements of the CDM-EB.

### 2.1 Objective

Validation is the process of an independent third party evaluation of a project activity against the requirements of the CDM as set out in the Article 12 of the Kyoto Protocol, the CDM M&P, the present annex, subsequent decisions made by the COP/MOP and CDM-EB, and the other rules applicable to the proposed project activity including the host country's legislation and its specific requirements for sustainable development on the basis of the PDD. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

### 2.2 Scope

The scope of validation is an independent and objective review of the project design. Review of the PDD is conducted against the requirements of KP, the CDM M&P and relevant decisions of the COP/MOP and the CDM-EB. LRQA follows a risk-based approach in the validation focusing on the identification of significant risks for project implementation and generation of CERs. Validation is not meant to provide any consulting towards the PP, however, the corrective actions requests (CARs) and clarifications (CLs) might provide input for improvement of the project design. A validation conclusion shall become final subject to the decision maker's review and the review by the LRQA Ltd.

## 2.3 GHG Project Description

The PP consists of 4 organizations. Daegu Metropolitan City is the municipal government who owns the project landfill site. Taegu Energy and Environment Co., Ltd. is a consortium lead by Taegu City Gas Corporation and participated in by the other 4 private enterprises aiming at development and operation of the landfill recovery and energy supply project under 20 years build-transfer-operate (BTO) contract with Daegu Metropolitan City. Ecoeye Co., Ltd. is the project consultant who supports the design and implementation of the CDM project activity. The additional one is Korea District Heating Corporation (KDHC), who is a public entity responsible to operate the district heating plants that destruct the refined LFG to generate thermal energy and undertake monitoring of LFG destruction at the boilers.

The investment is funded by the group of private companies and the project financing by private financial institutes. The financial plan consists of 25% equity and 75% loan without Government guarantee and no public funding considered as diversion of official development aid (ODA) is included in the funding sources.

The project is aiming at implementation of capturing, refining and utilization of LFG from the existing Bangcheon-Ri landfill site in Daegu city, Republic of Korea. Bangcheon-Ri landfill site was designed to have capacity of 15,670,000 tons of municipal solid waste (MSW) from Daegu City. The capacity is being expanded to receive further 9,144,710 tons of MSW until 2026. The state-of-art technology is employed for the project activity in order to effectively capture the LFG and refine it to provide stable quality of fuel gas. This is one of the first kind projects in Korea. The project is to install vertical gas collection pipes and refinery facilities in order to capture LFG effectively and utilize it for energy generation. The design capacity of the project is 130 Nm<sup>3</sup>/min. of LFG to be supplied to the consumer and 1.5MW of power generating units for internal use. The proposed project activity will reduce emission of greenhouse gases (GHGs) by destruction of methane and displacement by the LFG captured and refined of the other energy use in the absence of the proposed project activity. But no emission reduction is claimed by the proposed project for the displacement of energy from the other sources.

The amount of ERs in average of the first 7 years crediting period is estimated at 404,872 tCO<sub>2</sub> per year.

## 3 Methodology

### 3.1 Review of documents

The validation is performed primarily based on the review of the PDD and the other supporting documentations. The PDD Version 01 dated 18 August 2006 was reviewed and LRQA requested the PP to present the supporting information and documents related with the project design and such additional information and documents were also reviewed by LRQA. Through the process of the validation, the PDD and the supporting documents of the same were evaluated to confirm the actions taken by the PP to the CARs and CLs issued by LRQA. The documents reviewed by LRQA are listed in the Appendix B.

### 3.2 Follow-up interviews

Follow-up interviews with the stakeholders and field survey were conducted to the parties and in the schedule as below.

11 Sep. 2006	Daegu Metropolitan City Government Ecoeye Co., Ltd. Supporting committee for local community near Daegu City Sanitary Landfill Taegu Energy & Environment Co., Ltd.
12 Sep. 2006	Daegu Regional Environmental Office Korea District Heating Corporation Daegu Branch Office The Office for Government Policy Coordination
14 Dec. 2006	A public stakeholder meeting for DNA's approval process Ministry of Commerce, Industry & Energy Daegu Metropolitan City Government Korea District Heating Corporation Head office Korea Energy Management Corporation Ecoeye
4 Apr. 2007	Daegu Metropolitan City Government Taegu Energy & Environment Co., Ltd.

The list of persons interviewed is shown in the Appendix C.

### 3.3 Resolution of clarification and corrective action requests

Findings identified in the process are indicated under the titles Corrective Action Requests (CARs) and Clarifications (CLs). CARs and CLs require the PP to take relevant actions. Criteria for judging items as CAR or CL are as follows:

Corrective Action Request (CAR):

- 1) Non-conformity to the laws and regulations of the host country
- 2) Non-conformance with the Kyoto Protocol, CDM M&P and the other relevant criteria
- 3) Items which would affect CER calculation significantly

Clarification (CL) Request:

- 1) Insufficient descriptions from the viewpoint of accuracy, reliability, completeness, consistency and other criteria.
- 2) Ambiguous and difficult-to-understand descriptions, as well as matters for which additional descriptions are desired.

The objective of this phase of the validation is to resolve CARs and CLs which need to be addressed for positive conclusion on the project design. The resolution of CARs and CLs raised by LRQA is to be reflected in the revised PDD and submitted to LRQA for validation conclusion.

## 4 Validation findings

The findings of the validation are stated in the following sections. The further detail of each finding is shown in the Validation Findings Log.

The findings are structured based on the main validation scopes as follows.

- Participation requirements
- Project Design
- Baseline & Additionality
- Monitoring plan
- Calculation of GHG emissions
- Duration of the project activity / crediting period
- Environmental impacts
- Comments by Local Stakeholders

### 4.1 Participation requirements

The host Party of the proposed project is the Republic of Korea. Korea has ratified the Kyoto Protocol on 8 November 2002 and the CDM Review Committee of Office of the Prime Minister has been designated as the national authority for the CDM. The project has been proposed currently as a unilateral CDM project and no Annex-I project participant has been identified yet.

The written approval (LoA) of the proposed project activity dated 24 January 2007 was issued by the host country's Designated National Authority (DNA) and the contents of the LoA were confirmed against the requirements for the elements of written approval and found satisfactory.

One CAR (CAR4) and one CL (CL1) were issued related with the national approval that were subsequently addressed by the PP during the validation process as detailed in the validation findings log and closed appropriately.

### 4.2 Project design

The project is aiming at implementation of capturing, refining and utilization of LFG from the existing Bangcheon-Ri landfill site in Daegu city, Republic of Korea. Bangcheon-Ri landfill site was designed to have capacity of 15,670,000 tons of municipal solid waste (MSW) from Daegu City. The capacity is being expanded to receive further 9,144,710 tons of MSW until 2026. The project is to install vertical gas collection pipes and refinery facilities in order to capture LFG effectively and utilize it for energy generation. The design capacity of the project is 130 Nm<sup>3</sup>/min. The project would capture and refine LFG. And refined LFG is supplied to Korea District Heating Corp. to produce thermal energy and is also utilised for 1.5MW of power generating units for internal use. Produced thermal energy utilizing LFG at the district heating plant is supplied to the consumer. The project activity includes flaring and utilization of captured gas to produce electricity and thermal energy but no emission reduction is claimed for displacing or avoiding energy generation from other sources.



The project is to implement capturing, refining and utilization of LFG that is to contribute safety management of the existing landfill site, improvement of local pollution and displacement of other energy sources by renewable energy in addition to the reduction of GHG emissions.

The project started the operation from 1 October 2006 and the life time of the project is expected to be 20 years. The project activity is categorized in the sectoral scope 13 – Waste handling and disposal. The average GHG emission reductions (ERs) by the proposed project activity for the first 7 year crediting period is estimated at 404,872 tCO<sub>2</sub> per year.

### 4.3 Baseline & Additionality

Originally the approved methodology ACM0001 Version 04 was applied to the project, however due to the revision of the methodology at 28<sup>th</sup> meeting of the CDM-EB, the consolidated baseline methodology for landfill gas project activity ACM0001 Version05 is applied to the project. The project activity captures LFG and uses the captured LFG to produce energy and meets the applicability criteria of the methodology.

The methodology defines that the project boundary is the site of the project activity where the gas is captured and destroyed/used. The project boundary includes the LFG destruction at the DH plant and transportation by pipeline. LRQA requested that PP to clarify the extent of the project boundary which ended up with the revision of the description in section B.3 of the PDD. The revision clarified that the LFG destruction at the District Heating plant is included in the project boundary that conforms the baseline methodology. Emission reductions by displacement of energy from other sources by boilers of KDHC are not claimed by this project activity.

The baseline is stipulated in the applied methodology that the atmospheric release of LFG with some of the methane generated by the landfill may be captured and destroyed to comply with regulations or contractual requirements or to address safety and odour concerns. The baseline scenario chosen for the proposed project activity is continuation of the current practice at the Daegu Bangcheon-Ri Landfill, where a part of LFG is treated by simple burning system before implementation of the project activity. There is no quantified target in regulatory or contractual requirement for the project to destroy/combust methane in absence of the project. Hence, an adjustment factor (AF) is applied to calculation of the emission reductions based on the volume of LFG captured and destructed by the simple burning system in the absence of the project activity. The method to determine AF has been documented in the PDD and it is calculated at 14.79% for ex-ante estimation of the emission reduction. The methods for determination of the AF was reviewed by the validation team and judged to meet the current good practices.

Though no leakage effect is requested to be accounted under the methodology, the project has accounted for deducting the emission due to imported electricity to meet the project requirements. Proper monitoring and emission factor is detailed in the PDD in accordance with the approved methodology ACM0002 version 06.

The project activity will result in displacement of other energy sources by utilization of the captured landfill gas but it is confirmed that no emission reduction by the energy displacement is claimed by the project.

Additionality of the project was demonstrated based on the applied methodology using the "Tool for the demonstration and assessment of additionality" (Additionality tool) version 03.

Step 1 – The PP identified alternative scenarios in the absence of the CDM project activity below based on the methodology.

Scenario 1: Maintain the status quo, namely some LFG is flared to meet the regulations but the majority is to be released in uncontrolled manner.

Scenario 2: The proposed project undertaken without being registered as a CDM project activity, namely LFG is captured compulsory and flared or used for energy generation.

Scenario 3: Capturing and only flaring of LFG as a project activity that delivers outputs and on services with comparable quality.

It was confirmed through the validation process that the alternative scenarios to the proposed project activity are correctly identified. The project landfill has been annually inspected by the regional environmental office and the compliance to the regulatory requirements has been confirmed. The host country has no legal requirement with quantified target of capturing and destruction of LFG and the current situation is not likely to change in future. The scenario 3, Capturing and only flaring of LFG is a measure of landfill operator to reduce GHG emission with identical performance as project scenario and meets the regulatory requirements. However, it doesn't create any economic benefit other than CER revenue and doesn't satisfy national policy of promoting renewable energy. All the above 3 scenarios fulfil the applicable legal and regulatory requirements and the project satisfies the Sub-step 1b.

Step 2 – The project activity will have the revenue from sale of LFG based gas to be supplied to the DH plant for producing thermal energy and a benchmark analysis has been applied to the project activity. The alternative scenario 1 is the present status and the alternative 3 will not produce economic benefit other than CDM related income and the choice of analysis method to be applied only to the alternative scenario 2 is considered appropriate. The financial indicator identified is IRR.

The PP applied the Government bond rate that is added with a risk premium suitable for a kind of private investment project as the benchmark. The benchmark is 7% that consists of average government bond rate during 2004~2005 at 4.2% and risk premium of 2.8% that is substantiated by independent financial expert. The PP calculated the project IRR to the lifetime long cash flow, namely for 2005 to 2026. The investment analysis was presented in a transparent manner so that the resulting IRR can be re-produced. The project's revenue is based on the sales of LFG based gas to the DH plant in accordance with the gas supply agreement. The main cost items are the construction cost, operation cost and taxes. LRQA requested the PP to present supporting evidences and those have been verified. The IRR is calculated at 4.754% that is lower than

the benchmark of 7%. Sensitivity analysis was performed with variations of parameters, 1) increase of unit sales price of LFG, 2) decrease of construction cost and 3) decrease of O&M cost. The sensitivity analysis shows increase of IRR to be 5.12% to 5.79% that are all still lower than the benchmark. As a result, the proposed project activity can not be considered as financially attractive without CER.

Step 3 – Barrier analysis is not selected and hence not applicable.

Step 4 – It has been demonstrated and verified during the validation that the similar activities as the proposed project activity are not widely observed nor commonly carried out in the host country except some cases being under development as CDM project activity and the proposed project activity is not considered as the common practice.

In the course of validation one CAR (CAR5) and seven CLs (CL 2, 3, 4, 5, 9, 10 & 12) were issued, which were subsequently addressed by the PP as detailed in the validation findings log and closed appropriately.

#### 4.4 Monitoring plan

The consolidated monitoring methodology for landfill gas project activities ACM0001/Version 05 was applied to the project.

In accordance with requirements of the applied monitoring methodology, monitoring based on the direct measurement of LFG captured and destroyed at the flare platform, electricity generating and thermal energy units are applied to determine the quantities. The following parameters are monitored

- landfill gas captured – measured by flow meter
- landfill gas used for power generation – measured by flow meter
- landfill gas used for thermal energy generation in boiler – measured by flow meter
- landfill gas flared – measure by flow meter
- methane fraction in landfill gas – measured continuously by gas analyser
- Volumetric flow rate of residual gas – measured continuously by flow meter
- Methane fraction in the landfill gas - measured using gas analyser
- temperature and pressure of landfill gas – measured
- Electricity imported from the grid – measured
- Grid emission factor – calculated
- Operating hours of the power plant and boiler
- Regulatory requirements
- LNG use – measured by flow meter

Although the project has back-up systems to supply LNG based gas following the specific requirements of the gas user, it was confirmed that the supply of LNG based gas is not expected to take place in the normal operation and it is not counted at all in the estimation of the emission reductions nor in the financial analysis. In the normal operating conditions, the project is to be operated solely

based on the LFG based gas and the approved monitoring methodology is applied without alteration. Hence requesting for revision or deviation to the approved methodology is not considered as applicable to the project case. The PP presented the detail procedures for the monitoring in the event the injection of LNG based gas takes place in item 1. of the Annex 4 of the revised PDD separately from the procedures for normal operation. The detail procedures were reviewed and judged by validation team as appropriate.

The project also contains transportation to and destruction of recovered LFG at the DH plant outside the landfill. But by inclusion of the DH plant and pipeline in the project boundary as mentioned in the section 4.3 above, all sources of GHG emissions are now captured by the approved monitoring methodology. Therefore requesting for revision or deviation to the approved methodology is not considered as applicable to the project case for this point.

The monitoring and reporting systems of emission reductions are well provided by the PP. The measuring equipments are in places with accuracy and regular calibration norms. The monitored data is to be automatically transmitted to the control instruments and regular data audits are provided to maintain the high reliability of emission reductions calculation.

During the validation process, two CARs (CAR1, CAR6) and two CLs (CL 8 & 11) were issued, which were subsequently addressed by the PP during the validation as detailed in the validation log and closed appropriately.

#### 4.5 Calculation of GHG emissions

The emission reductions by the project activity are estimated following the applied methodology. The methodology defines the formula ;

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

The project activity will result in displacement of other energy sources by utilization of the captured landfill gas but it is stated that no emission reduction by the energy displacement is claimed.

The ACM0001 says no leakage effect needs to be accounted under the methodology, but the electricity imported from the grid to meet the operational requirement of the project activity is considered as leakage emissions. Through the validation process, it was confirmed that no electricity export to the grid systems is anticipated in the proposed project activity. The project systems are designed to require 1.25MW of electricity as the average. The on-site electricity generators are installed but annual deficit is estimated at 3,898MWh and it is to be met by import from the electricity grid. The emission factor is calculated by applying the approved methodology ACM0002 version 06 as combined margin (CM) of operating margin (OM) based on the simple OM using recent 3 year average and build margin (BM) based on the ex-ante calculation of recent 20% capacity additions. Proportion of the low-cost/must run resources of the Korean National Grid as the average of most recent 5 years is less than 50% and in absence of relevant dispatch data, use of simple OM method is acceptable. The default weight  $w_{OM}=w_{BM}=0.5$  is applied as the selected grid and the project activity do not fall in the specific cases indicated in the guidance on selecting alternative weights. The estimated  $EF_{EL,leakage}$  is 0.5554tCO<sub>2</sub>/MWh and the emissions by use of grid electricity is estimated as 2,165.06tCO<sub>2</sub>/year. The details of determination of the CO<sub>2</sub> emissions intensity of the electricity imported are presented in Item 3. of the Annex 4 in the revised PDD. The details were reviewed by validation team and judged as appropriate.

Therefore the emission reductions are estimated for the project activity as below.  
 $ER_y = (MD_{project,y} - MD_{reg,y}) * GWP_{CH_4} - leakage.$

$MD_{reg,y}$  above is to be calculated as  $MD_{project,y}$  multiplied by an adjustment factor (AF) estimated at 14.79%. Destruction efficiency of the existing flaring stacks (simple burning systems) is considered as 100% for conservativeness. The detail procedures for determination of AF are documented in item 2 of Annex 4 to the revised PDD. The procedures are developed in line with a national survey conducted by the Ministry of Environment and validation team judged that the procedures meet the current good practice.

The methodology requires the PP to provide ex-ante estimate of emission reductions by projecting the future GHG emissions of the landfill while the amount of methane destroyed by the project activity is to be determined ex-post by metering the actual quantity of methane captured and destroyed once the project activity is operational. The volume of landfill gas to be generated is estimated based on the record of actual waste disposal since opening year of the landfill and forecasted volume of waste disposal during the project period based on the regression analysis. The estimation was conducted based on the Tier 2 method of IPCC guideline the First Order Decay model of US EPA and the result of estimation was checked with the performance results of the field tests. The methane generation potential of the waste  $Lo$  with conservative value of 112.1Nm<sup>3</sup>/ton-waste and the decay constant ( $k$ ) value of 0.067/year for the type of waste used was confirmed to be appropriate during the validation.

The formula presented in the Annex 3 of the revised in the revised PDD is as  $Q = Lo R (e^{-kc} - e^{-kt})$  which is as provided in revised 1996 IPCC guideline.

The estimated annual average emission reduction of the project activity is 404,872tCO<sub>2</sub>e and total 2,834,107tCO<sub>2</sub>e of emission reduction is estimated to be achieved during the first 7 year crediting period. However, experiences with other landfills have shown that the methane generation and collection efficiency of the landfills projected by the first order decay model has an inherent uncertainty and hence the amount of CERs, which will be monitored ex-post, might vary from the projected amount.

#### 4.6. Duration of project activity / crediting period

The starting date of the project activity is 01/05/2005 and expected operational lifetime is 20 years. The BTO contract was first signed in February 2004 and the revised contract was signed in February 2005 with change of the project costs. Following the final approval from the municipal Government, the construction was started in May 2005. The concession contract for development and operation of the LFG recovery and energy supply project is valid for the period of 20 years from the date of the commercial operation until September 2026 that includes the collection and use of gas after closure of the landfill.

The project has chosen the renewable crediting period with the first 7 years crediting period expected to start from 1 August 2007.

Two CLs (CL6 & 7) raised related to this section were appropriately addressed and closed out during the validation period as detailed in the validation findings log.

#### 4.7 Environmental impacts

The project activity is not included in the category of activity that needs performing of environmental impacts assessment (EIA) under the legislation of the host county, while the approval from the regional environmental office has been obtained for the change in waste treatment facility and a documentation of analysis for environmental impacts has been reviewed and considered appropriate. The project is basically to contribute to improvement of local environment especially of reduction of odour while there is some increase of adverse impacts such as emission of combustion exhaust gases and noise/vibration from the on-site power generators that are to be controlled by the PP.

The electricity generators used in the proposed project are fallen into the category of equipment & facility emitting air pollutant according to Air protection Act. It is confirmed that the design specification meets the regulatory requirement. Also treatment standard of waste water effluent was checked. The waste water effluent from the facilities goes through simple sewage tank and is collected in leachate reservoir. The waste water together with the leachate is treated at the leachate treatment facility which has already been operating. This way of treatment meets the requirement of Water Quality Protection Act. The LFG pipeline to the KDHC was built in the existing landfill and along with existing road to minimise the adverse impacts on the environment and no deforestation is caused. The proper permits for the pipeline construction were acquired from the relevant government bodies prior to the construction.



During the validation process, one CAR (CAR2) was issued, which was subsequently addressed by the PP during the validation as detailed in the validation log and closed appropriately.

#### 4.8 Comments by local stakeholders

Comments from the stakeholders have been invited in various stages of the project through public media. The comments received were summarized in the PDD. The PP has taken account of comments received from the stakeholders and reflected in design and construction of the facilities.

Summary of related documents in English was provided in the revised PDD that included the media used, presented information, period allowed for comment, comments received and how those were taken into account.

The validation team has visited the landfill site and directly interviewed the representative of local community. The landfill is located in the controlled area separated from the residential area. The supporting committee for local community is monitoring the landfill operation so that any breach of legal requirements there can be reported to the public authority. And regular meetings are being held to reflect the stakeholders' opinion in the landfill management. The stakeholders are supportive to the proposed project activity because it contributes to improvement of local environment, uses renewable energy and extends the lifetime of the landfill.

During the validation process, one CAR (CAR3) was issued which was subsequently addressed by the PP during the validation as detailed in the validation log and closed appropriately.

### 5 Comments by parties, stakeholders and NGOs

In accordance with the requirement of paragraph 40 of the CDM M&P, the PDD is to be made publicly available for 30 days subject to confidentiality provisions agreed with the PP to receive comments from Parties, stakeholders and UNFCCC accredited NGOs on the validation and registration requirements.

The PDD Version 01 applied the approved methodology ACM 0001 Version 04 was first made publicly available to invite stakeholders' comments from 24 August to 22 September 2006 and no comment was received during the period.

Following the revision of the approved methodology, the PDD version 06 applied with ACM0001 Version 05 was made publicly available from 25 April to 24 May 2007 in line with requirements of CDM rules and no comment was received during the period.

### 6 Validation Opinion

*LRQA has undertaken the validation of the proposed project activity "Daegu Bangcheon-Ri Landfill gas CDM project" based on the requirements of CDM as set out in the Article 12 of the Kyoto Protocol, the CDM M&P, the present annex, subsequent decisions made by the COP/MOP and CDM-EB, and the other rules*

*applicable to the proposed project activity including the host country's legislation and its specific requirements for sustainable development.*

*It was demonstrated that the project is not a likely baseline scenario. Emission reductions which are to be achieved by the project are additional to any that would occur in the absence of the project activity.*

*Through the process of the validation, LRQA identified 6 CARs and 12 CLs and the PP has been taking actions to demonstrate that the proposed project activity is satisfying the requirements of CDM project and all the CARs and CLs have been closed out. LRQA reviewed the actions the PP took and considered those actions were appropriate to correct the findings.*

*It is LRQA's opinion that the proposed project activity meets all relevant UNFCCC requirements for the CDM as well as the host country's national requirements. Therefore LRQA request the registration of "Daegu Bangcheon-Ri Landfill gas CDM project" to the CDM Executive Board as a CDM project activity. The project activity is likely to achieve the emission reductions stated in the CDM-PDD Version 07 dated 15 May 2007.*



## 7 References

### 7.1 Appendix A: Letter of approval for the project by the host country DNA

Letter of Approval by the host country DNA was issued on 24 January 2007.

### 7.2 Appendix B: List of documents reviewed

#### Category A documents (Documents prepared by the PP)

- 1) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 07 dated 15 May 2007
- 2) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 06 dated 19 April 2007
- 3) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 05 dated 22 March 2007
- 4) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 04 dated 16 March 2007
- 5) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 03 dated 17 January 2007
- 6) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 02 dated 29 November 2006
- 7) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 01 dated 18 August 2006
- 8) The CDM-PDD for Daegu Bangcheon-Ri Landfill gas CDM project Version 01 dated 28 July 2006
- 9) Brief on LFG development Private Investment Project, Daegu Metropolitan City Government
- 10) Detail Design Report on Daegu Bangcheonri Sanitary Landfill Gas Development Project, Taegu Energy & Environment Co., Ltd., February 2005
- 11) Feasibility analysis and basic design report on Daegu Metropolitan City Sanitary Landfill Gas development, Daegu Metropolitan City Government, December 2001
- 12) Agreement on LFG Supply and Demand, Taegu Energy & Environment Co., Ltd. and Korean District Heating Corporation Daegu Branch Office, 23 December 2004
- 13) Agreement among Daegu Metropolitan City Government, Korean District Heating Corporation, Taegu Energy & Environment Co., Ltd. and Daegu City Gas Corporation, 5 November 2004
- 14) Request of consultation according to the approval of Private Investment Project, Daegu Metropolitan City Government, 12 January 2005
- 15) Process diagram for Daegu Bangcheon-Ri Landfill gas CDM project, Taegu Energy & Environment Co., Ltd., February 2005
- 16) Financial analysis of for Daegu Bangcheon-Ri Landfill gas CDM project

- 17) Volume of LFG generated for Daegu Bangcheon-Ri Landfill gas CDM project
- 18) Calculation of LFG for Daegu Bangcheon-Ri Landfill gas CDM project (Excel file)
- 19) Project plan, Taegu Energy & Environment CO., Ltd. 29 October 2002
- 20) Revised project implementation agreement on private investment project for Bangcheonri Landfill gas utilisation, Daegu Metropolitan City Government and Taegu Energy & Environment Co., Ltd. February 2005.
- 21) Detail design calculation (Mechanical works) for Bangcheon-ri Landfill gas project, Taegu Energy & Environment Co., Ltd. February 2005

**Category B documents (Other documents referenced)**

- 1) Revision to the approved consolidated baseline methodology ACM0001 "Consolidated baseline methodology for landfill gas project activities" ACM0001/Version 05 dated 12 December 2006
- 2) Methodological "Tool to determine project emissions from flaring gases containing methane" dated 12 December 2006
- 3) Tool for the demonstration and assessment of additionality/Version03 dated 15 February 2007
- 4) Revision to the approved consolidated baseline methodology ACM0001 "Consolidated baseline methodology for landfill gas project activities" ACM0001/Version 04 dated 28 July 2006
- 5) Revision to the approved consolidated baseline methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" ACM0002/Version 06 dated 19 May 2006
- 6) Research on DNA roles and future direction to facilitate CDM projects, Office of Government Policy Coordination, 2005
- 7) Remarks by President Roh Moo-hyun, Declaring a National Vision for Sustainable Development on the 10<sup>th</sup> Environment Day, 4 June 2005
- 8) Waste & Recycling – Overview of Policies & Efforts, Ministry of Environment, 15 March 2006
- 9) Act on Private Participation in Infrastructure
- 10) Presidential Decree on Waste Management, Ministry of Government Legislation, 13 July 2004
- 11) 2nd Demand-Supply Program of Electricity from 2004-2007, Ministry of Commerce, Industry and Energy, 4 December 2004
- 12) KEPCO in brief, KEPCO, as of 20 March 2006 / as of 31 December 2006
- 13) Statistics of Electricity Power in Korea (KEPCO 2003, 2004, 2005, 2006)
- 14) Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
- 15) IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
- 16) A Landfill Gas-to-Energy Project Development Handbook, United States Environmental Protection Agency, September 1996
- 17) Response form for request for clarification on approved methodology AM-CLA-0031 on "Applicability of the methodology for a project activity that aims to collect LFG and upgrade to CPLG" dated 13 September 2006
- 18) Country Analysis Briefs "South Korea", Energy Information Administration, the US Department of Energy
- 19) General specification for Vortex Flowmeter, Oval Corporation
- 20) Survey for estimating GHG emission and establishing statistics in Environmental sector, Ministry of Environment, August 2002

- 21) Survey for estimating GHG emission and establishing statistics in Environmental sector(Ⅱ), Ministry of Environment October 2003
- 22) JSME Steam Tables, The Japan Society of Mechanical Engineers (JSME)
- 23) Steam Tables, Basic Principles and Calculations in Chemical Engineering 6<sup>th</sup> Edition, David M. Himmelblau
- 24) Air protection Act
- 25) Water quality protection Act
- 26) Study on establishing the foundation to develop the UNFCCC 3rd national report - Study on improvement of GHG emission statistics system for waste field, Kyung-Sic Choi & Jae-Kyu Lim, Korea Energy Economy Institute

### 7.3 Appendix C: List of persons interviewed

Daegu Metropolitan City

- Mr. Han Soo Kim, Manager of Resource Recirculation Division

Taegu Energy & Environment CO., Ltd.

- Mr. Young Bok Moon, Director
- Mr. Yong Sang Lee, General Manager
- Mr. Tae Gyun Jung, Senior Manager of Business Management Team
- Mr. Myoung Won Lee, Manager of Operation Team

Ecoeye Co., Ltd.

- Mr. Sang Jueon Ahn, Team Manager of Sustainability Management Team
- Ms. Na Hyun Cho, Consultant, Carbon Marketing Team

Korea District Heating Corporation Daegu Branch Office

- Mr. Sung Chul Hong, General Manager of Operation Department
- Mr. Dae Hee Noh, Team Manager of Mechanical Department
- Mr. Jae Gyu Joo, Manager

Daegu Regional Environmental Office

- Mr. Sang Pal Nam, Chief Officer
- Ms. Jin Hee Hong

The Office for Government Policy Coordination

- Ms. Soon A Lee, Deputy Director, Industrial Policy Coordination
- Mr. Yeon Sang Lee, Expert Advisor for Climate Change, Industrial Policy Coordination

Supporting Committee for local community near Daegu City Sanitary Landfill

- Mr. Jae Sik Oh, President

Ministry of Commerce, Industry and Energy

- Mr. Byung Youl Lee,

Korea Energy Management Corporation

- Mr. Jae Hak Woo, Team Leader
- Ms. Gyung Ae Ha, Project Coordinator

Korea District Heating Corporation

- Mr. Sang Yoon Shin, Director/Neo-project team
- Mr. Jae Hoon Chung, General manager/Fuel Policy Team

#### 7.4 Appendix D: How due account has been taken to the public input made to the validation

The PDD was made publicly available twice due to revision of the approved methodology during the course of validation.

The PDD Version 01 applied the approved methodology ACM 0001 Version 04 was first made publicly available to invite stakeholders' comments from 24 August to 22 September 2006 and no comment was received during the period.

Following the revision of the approved methodology, the PDD version 06 applied with ACM0001 Version 05 was made publicly available from 25 April to 24 May 2007 in line with requirements of CDM rules and no comment was received during the period.

#### 7.5 Appendix E: Validation findings log

Attached to this report.

## Appendix A

### Letter of approval for the project by the host country DNA (English)

No. 2007-1

#### Approval of CDM Project

Mayor (Mr. Bum-il, Kim)  
Daegu Metropolitan City  
130, Gongpeongno, Jung-Gu, Daegu  
Republic of Korea

President & CEO (Mr. Young-Nam Kim)  
Korea District Heating Corporation  
186, Bundang-dong, Bundang-gu, Seongnam-si, Gyeonggi-do  
Republic of Korea

CEO (Dr. Jae-soo, Jung)  
Ecoeye Co., Ltd.  
153 Lordland building, Gumi-Dong, Bundang-Gu, Seongnam, Gyeonggi-Do  
Republic of Korea

President & CEO (Dr. Suk-hyung, Lee)  
Taegu Energy & Environment Co., Ltd.  
449, Bangchon-ri, Dasa-up, Dalsung-gun, Daegu  
Republic of Korea

**In respect of the Daegu Bangcheon-Ri Landfill Gas Project, in which the above-mentioned entities participate, the Government of the Republic of Korea hereby confirms the followings in accordance with the approval decision of the CDM review committee;**

- i ) The Government of Republic of Korea has ratified the Kyoto Protocol in November 2002.
- ii ) This is approval of voluntary participation in the proposed CDM project activity.
- iii ) This project contributes to Sustainable Development in Korea.

January 24, 2007

**Government of the Republic of Korea**

Ministry of Environment



Ministry of Commerce,  
Industry and Energy





(Korean)

승인번호 : 2007-1호

## 청정개발체제 사업 승인서

대구광역시 시장 김범일  
대구광역시 중구 공평로 130

한국지역난방공사 사장 김영남  
경기도 성남시 분당구 분당동 186번지

(주)에코아이 대표이사 정재수  
경기도 성남시 분당구 구미동 153

대구에너지환경(주) 대표이사 이석형  
대구광역시 달성군 다사읍 방천리 449번지

상기인이 참여하는 "대구 방천리 매립가스 사업"에 관하여 청정개발체제 심의위원회 (CDM Review Committee)의 결정에 따라 대한민국 정부는 각 호의 사항을 확인합니다.

- i) 대한민국은 교토의정서를 2002년 11월에 비준하였습니다.
- ii) 이 사업은 자발적 참여에 의한 것임을 승인합니다.
- iii) 이 사업이 우리나라의 지속가능한 발전에 기여하는 것으로 인정합니다.

2007년 1월 24일

대한민국정부

환경부 장관



산업자원부 장관







## CDM Validation Findings Log – Daegu Bangcheon-Ri Landfill gas CDM project Version 02 – 25 May 2007

Grade 1	Status 2	Finding 3	Corrective action review 4	Process / Aspect 5	Date 6	Ref 7	Clause 8
CAR	Closed	The project might use LNG but no formula to calculate emissions from the combustion of LNG was given in the PDD.	The formula to calculate the possible project emissions with LNG consumption as back-up fuel was added in the Annex 4 and it was confirmed as appropriate. CAR1 was closed out. 9 Mar. 07	Monitoring methodology & plan – PDD/B.7.1., Annex 4.	8 Sep. 06	CAR1	Para. 53 CDM M&P
CAR	Closed	The PDD stated that the documentation on the analysis of the environmental impacts of the project activity did not exist but the documentation on analysis of environmental impacts is to be presented along with the PDD to meet the mandatory CDM requirements.	The analysis has been added in the PDD and the main environmental aspects are explained. The documentation provided is considered as appropriate and the CAR was closed out. 10 Mar. 07.	Environmental impacts – PDD/D.1.	8 Sep. 06	CAR2	Para. 37 (c) CDM M&P
CAR	Closed	The Figures G-1 to G-13 should be translated in English so that the relevance of process invited comment from stakeholders can be clearly presented on the PDD.	Summary of related documents in English was provided in the revised PDD that included the media used, presented information, period allowed for comment, comments received and how those were taken into account. The actions taken by the PP for correction were considered as appropriate and the CAR3 was closed out. 19 Jan. 07	Stakeholders' comments – PDD/E.1.	8 Sep. 06	CAR3	Para. 37 (b) CDM M&P
CAR	Closed	LoA has not been issued by the host country's DNA.	The LoA was issued by DNA on 24 January 2007. The LoA meets the CDM requirements for written approval and therefore the CAR was closed out. 10 Mar. 07.	General description – PDD/A.3.	15 Sep. 06	CAR4	Para. 40 (a) CDM M&P
CAR	Closed	Use of past 10 years average discount rate as benchmark is not considered appropriate as it sharply increased during economic crisis period after 1997.	In the revised PDD, benchmark of 7% is proposed which is the government bond rate added with a risk premium substantiated by an independent financial expert. The government bond rate and the view from the financial expert were reviewed by the validation team and judged as appropriate. The CAR5 was closed out. 17 May 2007	Baseline and monitoring methodology - PDD/B.5.	15 Sep. 06	CAR5	Para. 44 CDM M&P
CAR	Closed	Ref. CL8. The detail means of monitoring and calculation with provision of LNG supply to address the case specific requirements of gas supply contract to the consumer should be properly documented so that the accurate measurement is ensured in a transparent manner.	The PP presented the detail procedures for the monitoring in the event the injection of LNG based gas takes place as back-up fuel in the Annex 4 of the PDD. The CAR was closed out. 9 Mar. 07.	Monitoring methodology & plan – PDD/B.7.1., Annex 4.	15 Sep. 06	CAR6	Para. 54 CDM M&P

1. Grades for findings \*

2. New, Open, Closed

3. Detail of findings

4. Review by LRQA

5. Details of Process, aspects, ref. to PDD

6. Date of findings

7. CAR/CL seq.#

8. Ref. to CDM Rules

\* CAR = Corrective Action Request

CL = Clarification Request



Grade 1	Status 2	Finding 3	Corrective action review 4	Process / Aspect 5	Date 6	Ref 7	Clause 8
CL	Closed	The PP should confirm approval of the CDM project activity by the host country's DNA.	Through the interviews with the PP and the host country government, it was confirmed that the LoA has not been issued for the project yet. CL1 was closed while CAR4 was raised instead. 15 Sep. 06	General description – PDD/A.3.	8 Sep. 06	CL1	Para. 40 (a) CDM M&P
CL	Closed	The project activity will result in displacement of other energy sources by utilization of the captured landfill gas but it was stated that the emission reduction by the energy displacement is not claimed. The PDD was not clear and consistent among the statements that needed clarification by the PP. In Page 11, it was said the captured gas will be used for producing thermal energy where emission reductions will be "claimed" and the equations (1) and (2) include EL <sub>y</sub> and ET <sub>y</sub> . ACM0002 was referenced in the applicability condition c) of ACM0001 that is not applicable to the proposed project activity, while it can be used to calculate emissions by use of electricity imported from the grid. Although ACM0001 says no leakage effect need to be accounted under the methodology, the electricity imported from the grid to meet the operational requirement of the project activity is considered as leakage emissions. The PP should clearly explain the energy needs of the project activity.	Through the validation process, it was confirmed that no electricity export to the grid systems is anticipated in the proposed project activity. The project systems are designed to require 1.25MW of electricity as the average. In-house electricity generators are installed but the deficit is to be met by import from the electricity grid. The PP has presented the revised PDD in which EL <sub>y</sub> and ET <sub>y</sub> were removed and the use of the grid electricity for the project activity is considered as leakage emissions. The detailed information of determination of the EF <sub>EL, leakage</sub> is provided in the Annex 4 of the PDD. These corrections are considered as appropriate. 19. Feb. 06.	General description – PDD/A.4.3. Baseline methodology – PDD/B.2., B.3., B.6.1., B.7.1., Annex 4	8 Sep. 06	CL2	Para. 37 (e), 51 CDM M&P
CL	Closed	The description of flaring systems was not clear in the PDD. Page 8 explained it was enclosed type but in Page 13, it referred to open type flare and 50% efficiency where no measurement of flare efficiency was planned was applied for estimation of emission reductions. It is also not clear in the monitoring plan whether the efficiency of flare was planned for the project activity or not.	Through the validation process, it was confirmed that the applied systems are open type flare and relevant measurement of flare efficiency requested in ACM0001, specifically periodic measurement of methane content of flare exhaust gas, was not planned to be undertaken. In the revised PDD, the relevant description on the flaring systems applied in the project activity including the monitoring plan was corrected. The CL3 was closed out. 19 Jan. 07	General description – PDD/A.4.3. Baseline methodology – PDD/B.6.1. Monitoring methodology & plan – PDD/B.7.1.	8 Sep. 06	CL3	Para. 37 (c) CDM M&P

1. Grades for findings \*

6. Date of findings

2. New, Open, Closed

7. CAR/CL seq.#

3. Detail of findings

8. Ref. to CDM Rules

4. Review by LRQA

5. Details of Process, aspects, ref. to PDD

\* CAR = Corrective Action Request

CL = Clarification Request





Grade 1	Status 2	Finding 3	Corrective action review 4	Process / Aspect 5	Date 6	Ref 7	Clause 8
CL	Closed	It was stated that some of the landfill gas was collected and destructed to meet the requirement of regulations. The PP should clarify if any other mean of MSW management can be considered as realistic and credible alternative. That is to be considered in Step 1 of Tool for the demonstration and assessment of additionality if any. The national requirements to the LFG treatment was not clearly defined with quantified standards or criteria that was making it difficult to confirm the level of the LFG treatment required by the regulation and in the absent of the CDM project activity. The PP was requested to clarify the level of LFG collection and destruction required to comply with the host country's regulation that is necessary to justify the proposed adjustment factor (AF) of 4% as well. How to monitor the regulatory requirements in the monitoring plant should be specified in the PDD.	It was understood through the validation process that the alternative scenarios to the proposed project activity was limited through the validation process. LFG incinerator to only destruct LFG generated at landfill was added as the alternative scenario in the revised PDD. This meets the guidance of the Additionality Tool. In the revised PDD, the detailed procedures for determination of AF are documented in item 2 of Annex 4 to the revised PDD. AF is estimated at 14.79% based on the survey result by the MoE. The procedure was developed in line with the survey conducted by the MoE and judged as meeting the current good practice. CL4 was closed out. 17 May. 07.	Baseline methodology – PDD/B.5.	8 Sep. 06	CL4	Para. 44 CDM M&P
CL	Closed	The PP should clearly state how the referenced benchmark rate is applicable to the proposed project activity with justification of figures used in the economic analysis. The use of past 10 years financial indicator is not considered appropriate as it sharply increased during economic crisis period after 1997. Please refer to CAR5 on this point.	The PP presented the supporting materials for the figures used in the economic analysis. The PP has revised construction cost, income tax and revenue from LFG sales were corrected during the clarification process. The relevant evidences were thoroughly reviewed and confirmed correct. The CL was closed out. 23 Mar. 07.	Baseline methodology – PDD/B.5.	8 Sep. 06	CL5	Para. 44 CDM M&P
CL	Closed	The starting date of the project activity was indicated on 01/10/2006 while it was said that the construction has started in March 2005. The PP should clarify.	The starting date of the project activity was corrected to 01/05/2005 in the revised PDD that is based on the commencement date of the construction work. The correction is considered as appropriate and the CL6 was closed out. 19 Jan. 07	Baseline methodology – PDD/B.5. Duration/Crediting period – PDD/C.1.1.	8 Sep. 06	CL6	Guidelines for completing CDM-PDD
CL	Closed	The operational lifetime of the project activity was indicated as approximately 20 years. The PP should clarify how the duration of the project activity was determined in consideration of the operational life of the landfill site until 2024 and the gas generation potential and any other factors.	It was confirmed that the concession contract for development and operation of the LFG recovery and energy supply project is valid for the period of 20 years from the date of the commercial operation which is expected to be until September 2026. The CL7 was closed out. 15 Sep. 06	Duration/Crediting period – PDD/C.1.2.	8 Sep. 06	CL7	Guidelines for completing CDM-PDD

1. Grades for findings *	2. New, Open, Closed	3. Detail of findings	4. Review by LRQA	5. Details of Process, aspects, ref. to PDD
6. Date of findings	7. CAR/CL seq.#	8. Ref. to CDM Rules		
* CAR = Corrective Action Request	CL = Clarification Request			



Grade 1	Status 2	Finding 3	Corrective action review 4	Process / Aspect 5	Date 6	Ref 7	Clause 8
CL	Closed	The proposed project activity was presented that might mix air or LNG with LFG to stabilize the quality of gas that is to be supplied to the district heating plant. The indicators ID Nos. 2, – 4, for the volume of landfill gas are consider unable to be measured directly by the flow meters and the detail methods to calculate the volume from the monitored data of the mixed gas should be clearly described in the monitoring plan.	The details of project design and the energy supply systems with monitoring equipments in the project site were reviewed by the validation team and it was confirmed that both of the contract and the project design are based on the volume and energy content of LFG to be recovered only and the result of field tests also showed the LFG to be recovered can satisfy the energy requirements agreed with the consumer. Provision of LNG supply was requested by the consumer as the back-up systems to prevent the cut-off of fuel supply. The detail means of monitoring and calculation have been presented by the PP for review of LRQA and those were considered appropriate though it needs to be modified and should be properly documented so that the accurate measurement is ensured in a transparent manner. CL8 was closed while CAR6 was issued to follow-up the issue. 15 Sep. 06	Monitoring methodology & plan – PDD/B.7.1., B.7.2., Annex 4	8 Sep. 06	CL8	Para. 54 CDM M&P
CL	Closed	The description of the project boundary was not clear. Producing of thermal energy should be inside the project boundary.	LFG destruction at KDHC plant was included in the project boundary in the revised PDD. CL9 was closed out. 9 Mar. 07.	Baseline methodology – PDD/B.3. Monitoring methodology & plan – PDD/B.7	8 Sep. 06	CL9	Para. 37 (e), 52 CDM M&P
CL	Closed	The PP applied the First Order Decay model of US EPA to ex-ante estimation of emission reductions. The formula quoted in the PDD and the one actually used for calculation are not the same.	The PP corrected the formula in the annex 3 to original equation provided by US EPA model. CL10 was closed out 13 Mar. 07	Baseline methodology – PDD/Annex 3	15 Sep. 06	CL10	Para. 44 CDM M&P
CL	Closed	Flare operation parameters should be provided to monitor whether the flare operates within the range of operating conditions.	The PP provided T_flare (Temperature in the exhaust gas of the flare) with description that flare operation time are monitored on a real-time basis. And the data is saved at the computer automatically and flame detector was also added as a parameter. The PP indicated flare specification and required data and procedure on the revised PDD. CL11 was closed out. 19 May 2007.	Monitoring methodology – PDD/B.6.2	12 May. 07	CL11	Para. 54 CDM M&P
CL	Closed	The PP stated in the PDD that $f_{V_{CH_4, RG, n}}$ would be calculated when LFG is analysed. The method to calculate the volumetric fraction of methane in the residual gas on dry basis should clearly indicate in the PDD.	It was confirmed that the volumetric fraction of methane in the residual gas on dry basis in the PDD. The LFG condition after cooler is maintained as dry basis. CL12 was closed out 18 May 2007	Baseline methodology – PDD/6.3	12 May. 07	CL12	Para. 44 CDM M&P

1. Grades for findings *	2. New, Open, Closed	3. Detail of findings	4. Review by LRQA	5. Details of Process, aspects, ref. to PDD
6. Date of findings	7. CAR/CL seq.#	8. Ref. to CDM Rules		
* CAR = Corrective Action Request	CL = Clarification Request			

## CURRICULUM VITAE

NAME : PRABODHA CHANDRA ACHARYA  
NATIONALITY : INDIAN  
PASSPORT NO. : A-6715115  
DATE OF ISSUE : 21 Jan 1999

AGE : 38 Years  
DATE OF BIRTH : 27.03.1968  
ISSUED AT : CALCUTTA  
DATE OF EXPIRY: 20 Jan. 2009

### CURRENT DUTIES & RESPONSIBILITIES

Presently posted at Bangalore undertaking the following activities of Lloyd's Register Quality Assurance Ltd. (LRQA):

1. Assessment/auditing for management system certification of Occupational Health & Safety (OH&S) System (OHSAS 18001:1999), Environmental Management System (ISO 14001:2004) and Quality Management System (ISO9001:2000) on behalf of LRQA, U.K.
2. To conduct training courses on Environmental Management Systems and OH&S systems including the 5-day EMS & OHSAS Lead Auditor's course on behalf of LRQA, U.K.
3. Technical Review of Environmental Management Systems and OH&S systems audit reports for authorising Certification.
4. Validation, verification and certification for Green House Gas (GHG) emission under Clean Development Mechanism (CDM)
5. Non-certification (2<sup>nd</sup> Party Audit) services on Occupational Health Safety and Environment Management systems related services for the Coke plants.

### CAREER SUMMARY

After passing out from Indira Gandhi Institute of Technology, Utkal University, Orissa in June 1990 with B.E. (Civil Engineering) (Hons), continued higher study for M.Tech. in Environmental Engineering at Indian Institute of Technology, Kharagpur till January 1992. Practised as a consulting Civil Engineer till July 1992. Joined Steel Authority of India Limited (SAIL) in July 1992 as Management Trainee (Technical) at Bhilai Steel Plant. Subsequently worked in the Environment Management Division (EMD) of SAIL from January 1993 and worked my way up to Manager in July 2002. Joined Lloyd's Register during October 2003 as an Engineer Surveyor.

### QUALIFICATIONS

#### ACADEMIC:

- M.Tech. (Environmental Engineering) from IIT, Kharagpur (August, 1990 to January 1992) – 1<sup>st</sup> in the batch with 9.18 CGPA.
- B.E. (Civil Engineering) from IGIT, Talcher under Utkal University, Orissa (June 1986 to June 1990) – 2<sup>nd</sup> in the University with 84.5% marks.

PROFESSIONAL: Life Member of the Millennium Institute of Energy & Environment Management  
(Member Ship No. LM 0111)

### PROFESSIONAL EXPERIENCE

OCTOBER'2003 - TO DATE: LLOYD'S REGISTER QUALITY ASSURANCE LTD.

**Working as an EMS, OHSAS & QMS Lead Auditor, EMS & OHSAS Lead Tutor and CDM GHG Validator & Verifier.**

Third party assessments for certification to ISO 9001:2001, ISO14001:2004 standards and OHSAS 18001:1999 for certification services to various service industries, manufacturing organisations, consulting firms and engineering industries and client training on EMS & OHSAS Auditor/Lead Auditor for IRCA registered and non registered courses. Providing second party auditing services to clients on OHS and EMS as per the client criteria. Validating Green House Gas (GHG) emission reduction projects under Clean

Development Mechanism (CDM) as per the Kyoto Protocol. The list of CDM projects being undertaken is as below:

- Jatropha curcus based bio-diesel production project in Tamil Nadu under the CDM model validation program of the Ministry of Environment, Japan
- 10MW waste heat recovery based captive power project based in Jharkhand
- 20MW waste gas based captive power project based at Kharragpur, West Bengal
- Methane recovery from waste water treatment in seafood industry in Maharastra
- Industrial fuel switching from lignite to natural gas at textile industries in Gujarat

#### **JANUARY 1993 – SEPTEMBER 2003: ENVIRONMENT MANAGEMENT DIVISION, SAIL**

**Worked in different capacities from Junior Manager to Manager and was involved in different project activities and responsibilities as detailed below:**

Identification of pollution monitoring and control requirements for three of the major integrated iron and steel plants of SAIL located at Bhilai, Bokaro & Rourkela, 11 numbers of iron ore mines, three coal mines and four flux mines (limestone & dolomite) as required for the statutory compliance requirement. Co-ordinating with the regulatory agencies like Central Pollution Control Board, concerned State Pollution Control Boards and the concerned Environmental Control Departments of the SAIL units for effective implementation of company's environment management policies and meeting statutory requirements. Providing general awareness training on environment management issues of Steel Plants and Iron Ore Mines to SAIL employees. Was Co-ordinating with the joint committee on Health, Safety and Environment of the organisation at corporate level for all its five integrated steel plants, four special steels plant and 25 numbers of captive mines on the health, safety and environment issues and performance of the company in SHE areas.

Initiated and Implemented Environmental Management Systems at different units of SAIL i.e. Meghahatuburu Iron Ore Mines, Kiriburu Iron Ore Mines, Salem Steels Plant, Plate Mill of Bhilai Steel Plant, Dalli Iron Ore Mines and Rjahara Iron Ore Mines leading to ISO 14001:1996 certification.

Conducted Environment Impact Assessment (EIA) studies as required for the environment clearance of different development projects, which includes expansion, capacity augmentation and modernisation. The studies included establishing project requirements, design of monitoring network, generation of baseline data for air, water and noise quality, terrestrial & aquatic ecology, land use, water use, soil and socio-economic studies etc., assessment of environmental impacts and formulation of appropriate management plans. These studies were conducted as per the guidelines of the Ministry of Environment and Forests (MoEF), Govt. of India from time to time and reports submitted to the EAC for the environmental clearance as required by the project authorities. The list of such EIA/EMP studies conducted is summarised below:

- Comprehensive EIA study for the opening up of new opencast iron ore mines at Meghahatuburu and Kiriburu, West Singhbhum, Jharkhand *(Was continuing the study. Could not complete as left the organisation before the completion of the study)*
- Rapid EIA study for the Capacity augmentation of Hirri Dolomite Mines, Bhilai Steel Plant.
- Rapid EIA study for the Gas fired Power Plant of Maharastra Elektros melt Limited (MEL), a subsidiary of SAIL.
- Comprehensive EIA study for the 4.0 MPTA expansion and modernisation of Bokaro Steel Plant, Bokaro as part of the post project completion environmental clearance compliance requirement from the Ministry of Environment and Forests (MoEF), Govt. of India.
- Rapid EIA for the Opening up of Kemmangundi Iron Ore Mine of Visvesvaraya Iron & Steel Plant, Bhadarvati, Karnataka.
- Comprehensive EIA with DMP for the expansion with Hot Rolling facilites of Salem Steel Plant, Salem, Tamilnadu
- Comprehensive EIA for the Expansion and modernisation of Bolani Ores Mines, Orissa
- Rapid EIA for Expansion and modernisation of Ispat Limestone Mines, Satna, Madhya Pradesh
- Rapid EIA for Expansion and modernisation of Purnapani Limestone & Dolomite Quarry, Orissa

Besides the above studies, co-ordinating and reviewing all the EIA studies conducted by different consultants engaged by Steel Authority of India Ltd. during 1996 – 2004 from time to time. The important among them are:

- a. EIA-EMP study for SAIL - L&T - CEA Joint Venture 2 x 250 MW Thermal Power Project at Bhilai, Madhya Pradesh conducted by M/s GBA Calcutta,
- b. Bio-diversity study conducted as per t of the EIA study for opening up of Iron Ore Mine in the Rowghat Area of Chhatisgarh conducted by M/s CES, Delhi which was further investigated by M/s URS,Australia.

Conducted different specialised studies in the different SAIL units as per requirements on the following issues:

1. Developed the Disaster Management Plan for the Salem Steels Plant during its expansion of Cold Rolling Facility as a part of the EIA study.

*The disaster management plan was developed for the expansion of this steel plant, while seeking for environmental clearance from the Ministry of Environment and Forests. Two phase risk analysis was used before development of the disaster management plan. The phase 1 was Maximum Critical Accident (MCA) Analysis, which relates to an accident with maximum damage distance believed to be probable. The phase II was Hazard Analysis, assessment and evaluation based on detailed hazard and operability (HAZOP) study. While detail HAZOP studies were carried out for most hazardous sections, the other was covered through checklist approach. Potential hazard of level I and level II could be identified for the steel plant, for which off and onsite emergency preparedness plane were developed.*

2. Development of Solid waste management strategies for the integrated steel plants. Wastes includes blast furnace slag., steel melting shop slag, fly ash from the captive power plants, mill scales, GCP sludges, etc.
3. Performance audit of the biological waste treatment unit (BOD plant) of Coke Ovens at Rourkela Steel Plant & Bhilai Steel Plant.
4. Prepared the “On-site Emergency Plan” for the Rourkela Steel Plant, specifically for the carbon monoxide (CO) release scenario.

*Rourkela Steel Plant was one among the five integrated steels plants under SAIL. While preparing the “on-site emergency plan”, it was necessary to predict the dispersion of Carbon Monoxide (CO) released in the probable emergency conditions. The study was conducted to predict the carbon dioxide concentration in case of an emergency release of the CO from the gas holders for the TLV (50ppm), STEL (400pm) and IDLH (1000pm) emission concentrations in the vicinity and appropriate emergency evacuation plan were developed. The GLC of CO emissions were predicted for seven different possible emergency conditions depending on the probable failure of the gas holders (Blast furnace gas holder, BOF gas holder and Coke Ovens gas holder) combined with the continuous intermittent emissions from the flaring stacks of Coal Chemical Department, BOF and BF. A Credible Scenario (which is more likely to occur or has the greater probability of occurrence) of emission was also considered for the prediction of the CO concentration in case the blast furnace gas holder develops a leakage from the bottom plate. The report was submitted to the local authority for their approval.*

5. Hazardous waste characterisation and development of management strategies for the wastes generated from the integrated steel plants and the mines.
6. Rehabilitation of mined out areas, degraded lands and waste dumps in the opencast mines.
7. Environmental auditing and preparing Environmental Statements
8. Air pollution dispersion modelling studies
9. Corporate Environmental Performance reporting including health and safety performance.

Initiated, planned and implemented Environmental Management Systems (EMS) leading to ISO14001 certification in SAIL plants and mines. Co-ordinating with the concerned units, conducting the Initial Environmental Review (IER), providing training on awareness and requirements of EMS, preparing and reviewing documents as required by ISO14001, conducting audits of the units, etc. Provided training on the basics and requirements of EMS to the senior SAIL executives as a guest faculty at SAIL's Management Training Institute (MTI), Ranchi.

Also established EMS in SAIL units and conducted audits on towards water management, waste management, rehabilitation, energy usage audits.

Provided and marketed environmental consultancies, some of which are briefed below:

1. Development of Clean Technology for Iron Ore mining and development of National Environmental Standards for emissions, effluents and noise pollution from various sources of iron ore mining. The study was initiated by CPCB, Ministry of Environment and Forests. The study covers all the working iron ore mines of India.
2. Description of Clean Technology and development of environmental standards for Integrated Iron and Steel making process in India. The study was a Central Pollution Control Board funded project. The study covered Bhilai, Bokaro, Rourkela, Durgapur Steel Plants of SAIL, IISCO, Burnpur, TISCO and RINL, Visakhapatnam.

Both these study included an evaluation and implication of the work environment and impact on occupational health of the pollution inside the work areas including the compliance requirement and feasibility as detailed in the Indian Factory Act, 1948. Both these study reports were submitted to the Ministry of Environment and Forests, Govt. of India.

3. Standardisation of environmental monitoring procedures for air, water and noise; identification of villages and colonies affected by air pollution and formulation of mitigation plans for Coal India Limited. The study was a World Bank funded project under Coal Sector Environmental and Social Mitigation Programme. The study was conducted in the 25 opencast coal mines under Central Coalfields Limited, Mahanadi Coalfields Limited, South Eastern Coalfields Limited, Northern Coalfields Limited and Western Coalfields Limited.
4. Conducted a Phase I Environmental Site Assessment (ESA), Limited Environmental Compliance Assessment (LECA), and Limited Health & Safety Assessment (LHSA) of the Diamant Private Limited property located at Chennai, Tamilnadu and Indiamant Private Limited property located at Vadodara, Gujarat.

*The objective of the LECA and LHSA was to evaluate whether there were any environmental non-compliance or occupational health & safety issues at the facility which might pose a significant potential liability to a prospective purchaser. The LHSA includes the evaluation of the Process Safety Management and Accidental Release Risk Management of the organisations. The LHSA involved evaluation of the Process Safety Management (PSM) programme, Process Hazard Analysis (PHA), PSM compliance audits, Risk Management Planning (RMP) and audit of Employee medical surveillance and records, means of Egress, noise exposure, hazardous waste operations and emergency response, PPE use, confined space entry, fire protection, etc.*

#### **FEBRUARY 2000 – JULY 2000: URS GREINER WOODWARD-CLYDE, AUSTRALIA**

**Worked with M/s URS Greiner Woodward-Clyde, Australia under the Australia India Business Exchange Programme in the following areas on different projects:**

- Environmental Site Assessment (ESA)
- Environmental Management Systems Audits
- Due Diligence Audits
- Mines Rehabilitation
- Environmental Audit
- EIA/EMP studies
- Environmental Monitoring
- Landfill Management including design, operation and post completion monitoring.

#### **JULY 1992 – JANUARY 1993: BHILAI STEEL PLANT, SAIL**

Undergone induction training and detailed training on the operation of integrated iron and steel making with special emphasis on the control of pollution, environment and safety management.

## TRAINING COURSES:

- Completed **Two day IRCA course on Accelerated Learning Workshop.**
- Completed **Two day LRQA training for Authorised Supervisor's Course** conducted during 23<sup>rd</sup> and 24<sup>th</sup> September 2005 at LRQA Mumbai.
- Completed **Two day LRQA training for Contact to Contract Course.**
- Completed **Five day LRQA training for Clean Development Mechanism (CDM)** conducted by M/s Entec, UK at Yokohama, Japan during 7<sup>th</sup> to 11<sup>th</sup> March 2005.
- Attended **Two day training programme on EHS Legislation in India and EHS Management System** conducted by Confederation of Indian Industry at New-Delhi during 21<sup>st</sup> to 22<sup>nd</sup> March 2005.
- Attended **One day awareness programme on "Environment Management Systems ISO 14001:2004-Final Draft"** conducted by Confederation of Indian Industry (CII) at Bangalore during July 2004.
- Completed **LRQA 3 day "International Deliverer's Course "** for presentation skills and techniques at Mumbai during October 2003
- Completed 5 day **"Quality Management Systems (ISO 9001:2000) Assessment Lead Assessor"** course at Khandala conducted by LRQA during September 2003.
- Completed IEMA approved **"Advanced EMS Auditor Course during 19.05.2003 to 23.05.2003"** conducted by M/s TQMI in conjunction with M/s TUV India Pvt. Ltd. at Management Training Institute (MTI) of SAIL at Ranchi.
- Undergone a specialised training course on **"Eco-restoration of Mined out Areas"** conducted during 30.09.1996 to 13.10.1996 by the Tropical Forest Research Institute, Indian Council of Forestry research & Education, Jabalpur, Madhya Pradesh.
- Attended a training course on **"Remote Sensing in Environment Impact Assessment"** during 18.12.1995 to 29.12.1995 conducted by M/s Centre for Study of Man and Environment, Kolkata.
- Completed a short course on **"Air Pollution Monitoring and Control"** held at Thapar Corporate Research Centre, Patiala during 24.10.1994 to 26.10.1994.
- Attended a national workshop on **"Air Pollution Dispersion Modelling – Indian Context"** held at Thapar Institute of Engineering and Technology, Patiala during 27.10.1994 to 28.10.1994.

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Tender to company – title – here if required

**NAME** Byong Un Heo

**POSITION** Management System Assessor

**BILLING GRADE**

## **CURRENT DUTIES AND RESPONSIBILITIES**

Quality management system and environmental management system audit to ISO 9000 and ISO 14000 standards for LRQA in Korea.

In-house and public quality management system and environmental management system training delivery services.

## **CAREER SUMMARY**

Worked for Hyundai Hysco Ltd., as quality engineer dealing welding and non-destructive testing for welded steel pipe manufacturing process, and carried out internal quality, environmental, health and safety management system audit. Prior to joining to Lloyd's Register, delivered quality, environmental, safety management system consulting services to various industrial sectors as a consultant of management system consulting company.

## **QUALIFICATIONS**

**ACADEMIC** B. Eng., Mechanical Engineering, Kyungpook National University, Korea 1984

**PROFESSIONAL** Qualified LRQA CDM Lead Validator/Lead Verifier training course, 2006  
IRCA Lead Auditor, QMS/EMS Reg. No. A007180, 1995  
ASNT NDT Level III, 1991

## **PROFESSIONAL EXPERIENCE**

**1995 – date** **LLOYD'S REGISTER**

**1997 - date** QMS/EMS Lead Assessor working for Lloyd's Register Quality Assurance Korea.

Quality management system and environmental management system audits mainly for companies of industrial sectors including metallurgical and mechanical engineering.

Training delivery services of quality management system and environmental management system.

Conducted EMS assessment more than 300 times from 1997 to current and these assessments include mechanical, metallurgical, electrical, electronic, chemical and petrochemical industry.

From the year 2002, conducted the EMS assessment for the administration services of local governments, such as Busan Metropolitan City and Ulsan Metropolitan City in Korea.



Tender to company – title – here if required

From the year 2005, conducted the assessment for the bottling companies of The Coca Cola Company under the scheme of the Global Audit Program of The Coca Cola Company.

Self-study of Chemistry and Physics of Atmosphere, Wastewater Treatment Engineering, Global Environment, Dust Reduction by reading technical books and journals.

Attended the EMS Lead Assessor Training Course (5 day) held by Korea Management Association in September 1999.

1995 - 1997

Engineering Surveyor working for Lloyd's Register Advisory Services Korea.

Quality management system and environmental management system advisory services to the standards such as ISO 9001, ISO 14001 and BS 7750 for companies of industrial sectors including metallurgical, mechanical, chemical and petrochemical, electronic and electric, and several service industry.

Training delivery services of quality management system and environmental management system for the above industrial sectors.

Development of quality management system and environmental management system training material.

Carried out quality management system and environmental management system audits mainly for companies of industrial sectors including metallurgical and mechanical engineering, as a subcontracting assessor of LRQA Korea.

Received on-the-job training from Mar. 1995 to Sep. 1997, on the subject of Prevention of Global Climate Change, Wastewater Treatment, Waste Management, Hazardous Material Management, Landfill and Land Contamination, by the instruction of Mr. Lewis Townson, LR Specialist.

Self-study of Air Pollution, Water Pollution, Soil Pollution Management, Waste Management and Environmental Law (especially local Korean environmental law) by the reading of professional and technical journals, books and other publications.

Attended the EMS Lead Assessor Training course (10 day) held by Lloyd's Register in March 1995.

Oct. 1992 – Feb. 1995

**QMS Engineering & Inspection Services Ltd.**

Management System Specialist and Engineering Surveyor working for QMS Engineering & Inspection Services Ltd.

Quality management system and environmental management system advisory services to the standards such as ISO 9001, ISO 14001 and BS 7750 and other quality and environmental management system standard for companies of industrial sectors including metallurgical, mechanical, chemical and petrochemical,

Tender to company – title – here if required

electronic and electric, and several service industry.

Delivery training services of quality management system and environmental management system.

Survey and inspection services of equipment including forgings, castings, fittings and equipment for power, oil and gas industries.

Non-destructive inspection services to metallurgical and mechanical industrial sector.

Self-study of Environmental Engineering and Clean Technology by reading the technical books.

Aug. 1984 – Sep. 1992

**Hyundai Hysco Ltd. (former Hyundai Pipe Company Ltd.)**

Quality Manager in steel pipe manufacturing plant. Internal auditing of company's quality, environmental, health and safety management system.

Quality planning for electric resistance welding and submerged arc welding steel pipe manufacturing.

Inspection and testing activities including non-destructive testing for steel pipes. Develop non-destructive testing procedure. Training and qualification of non-destructive inspector.

Welding and welding inspection engineer in steel pipe manufacturing. Developing and planning of welding procedure and welding inspection plan. Training of welding operator and inspector.

## PUBLICATIONS

**NAME** Seung Hyun Kwak

**POSITION** Marketing & Sales Executive

**BILLING GRADE**

## CURRENT DUTIES AND RESPONSIBILITIES

Marketing and Sales planning, market research, development of relationship with government officers, professionals and consultants who are specialised in GHG, CSR, etc. preparation of proposal, sales visit and provision of presentation at seminar and to clients.

## CAREER SUMMARY

Developed and implemented Environmental Management System in accordance with ISO 14001 and Occupational Health and Safety Management System in accordance with OHSAS 18001 and KOSHA 18001. Provided technical advice on Environmental issues from both domestic and overseas projects. Carried out internal HSE (Health, Safety and Environment) audit and 2<sup>nd</sup> party audit to subcontractors in accordance with ISO 14001 and OHSAS 18001.

## QUALIFICATIONS

### ACADEMIC

- Bachelor of Environmental Engineering in Konkuk University in February, 1996.
- Now taking MBA course in Korea University Business School

### PROFESSIONAL

- Qualified LRQA CDM Lead Validator/Lead Verifier training course, 2006
- Member of CDM Forum organised by Environmental Management Corporation, 2006
- Registered Engineer, Korean Construction Engineers Association, 1998
- Registered Environmental Engineer of Water Quality Control, Human Resources Development Service of Korea, August. 1994.
- Registered Environmental Engineer of Air Quality Control, Human Resource Development Service of Korea, December. 1994.

## PROFESSIONAL EXPERIENCE

2004 – Date

**LLOYD'S REGISTER Group**

February 2004 - Date

Lloyd's Register Quality Assurance Ltd.  
Marketing and Sales planning, market research, development of relationship with government officers, professionals and consultants who are specialised in GHG, CSR, etc. preparation of proposal, sales visit and provision of presentation at seminar and to clients.

April 2004 – January 2004

Hyundai Engineering & Construction Co., Ltd

- Development and implementation of Environmental management system in accordance with ISO 14001
- Development and implementation of Occupational Health and Safety management system in accordance with OHSAS 18001 and KOSHA 18001
- Development of Corporate HSE (Health, Safety and Environment)

- Management Document (Manual, Procedure and Instructions)
- Carrying out HSE audits on domestic and overseas projects
- Control of Environmental laws and regulation
- Certification management of ISO 14001, OHSAS 18001 and KOSHA 18001
- Development of web-based programme for overseas project HSE Management
- Provision of technical advice on Environmental engineering
- HSE Manager for Hong Kong Branch office
- Quality management system coordinator of Environment and Safety Department

## TRAINING

Sep. 2005	International Client Management Workshop (LRQA)
Aug. 2005	CDM training (Korea Energy Management Corporation)
Jun. 2004	Selling Skills Workshop (LRQA)
Apr. 2003	Construction KOSHA 18001 Consultant Course (Korea Occupational Safety & Health Agency; KOSHA)
Jan. 2003	OHSAS 18001 Lead Auditor Course (Korea Standard Association; KSA)
Jan. 2003	ISO 9001:2000 Transition Course (HDEC & LRQA)
Sep. 2000~Feb. 2002	Internal Graduate School of Hyundai Engineering & Construction Co., Ltd MBA Course
Nov. 1999	Project Management Course (HDEC)
Mar. 1998	ISO 14001 Lead Auditor Course (Korea Standard Association; KSA)
May. 1997	LCA Training (2 <sup>nd</sup> ) (Hyundai Institute of Eco-Management)
Nov. 1996	LCA Training (1 <sup>st</sup> ) (Hyundai Institute of Eco-Management)
May. 1996	ISO 14000 Specialist Course (Korea Standard Association; KSA)

NAME           Takahiro Iio

POSITION      Technical Manager

BILLING GRADE   5 (Lead Specialist)

#### CURRENT DUTIES AND RESPONSIBILITIES

1. Managing all Products including AS, TS, Food, Nuclear, ISMS and GHG
2. Technical support for QMS, EMS and SMS
3. Lead assessor of EMS and SMS, assessor of QMS
4. Lead Validator of CDM and JVETS
5. Technical Review of EMS and SMS
6. Development of new products.
7. Resources Authorizer of EMS and SMS

#### CAREER SUMMARY

Work with Environmental protection in Steel making plant in Japan and coal chemical plant in Australia.

Work with OHS in coal chemical plant in Australia

Manage companywide Environmental Protection of Steel, Aluminum, Copper, Welding and Machinery plant in head Office.

#### QUALIFICATIONS

ACADEMIC                   Sanitary Engineering, Hokaido Univ. 1975

PROFESSIONAL            Environmental Engineer  
CEAR EMS Lead Assessor (A7857)  
IRCA OHS Lead Auditor (1184374)  
IRCA QMS Auditor(1184374)  
Pollution Control Manager (Air No.1)  
Pollution Control Manager (Water No.1)  
Pollution Control Manager (Chief)  
Pollution Control Manager (Vibration)  
Pollution Control Manager (Dioxin)  
Dangerous Goods Handling Manager

#### PROFESSIONAL EXPERIENCE

2002 – date               LLOYD'S REGISTER

2002 – 2003              Experience  
EMS+SMS+QMS assessment and technical reviewer  
Development of GHG business

2003 – 2005              Experience  
EMS&OHS manager  
Development of GHG business

2005– date               Employer prior to Lloyd's Register Group  
Technical Manager

## PROFESSIONAL EXPERIENCE continued

Dates	Employer prior to Lloyd's Register Group
April, 1975--April, 1981 Dates	Experience Integrated Steel Making Plant of Kobe Steel Ltd., Employer prior to Lloyd's Register Group
Jan., 1986--Jan., 1992 Dates	Experience Coal Chemical Plant in Australia for Kobe Steel Subsidiary Company Employer prior to Lloyd's Register Group
Apr. 1981--Jan. 1986, Jan. 199--Feb. 2002 Dates	Experience Head Office of Kobe Steel Ltd.  Employer prior to Lloyd's Register Group
	Experience
Dates	Employer prior to Lloyd's Register Group
	Experience

## PUBLICATIONS

**None**

NAME Dr Anne-Marie Warris

POSITION Global Product Manager – Climate Change

#### CURRENT DUTIES AND RESPONSIBILITIES

Anne-Marie Warris's role includes developing and supporting new environmental based services and ensuring the technical integrity of the LRQA environmental services including external and internal liaison and support. Anne-Marie is the UK expert to International Organization for Standardization TC207 (ISO14000) committees, specifically those on green house gas, the joint CASCO/ISO committee of accreditation requirements for greenhouse gas and ISO 14001. She provides input to European accreditation committee on greenhouse gas where she acts as the Secretary. Anne-Marie is vice chair of the ETG Limited, which acts as a forum for emission trading issues within the UK, and she is chair of the working group on verification, monitoring and reporting of the ETG Limited.

#### CAREER SUMMARY

Dr Warris has been with the LR group for over 15 years. Since joining LRQA in 1995 she has been actively involved in developing the integrity and services provide by LRQA in the Environmental field. This includes EMS, EMAS and GHG. She represents IIOC at International Accreditation Forum meetings relating to EMS, at European Accreditation Co-Operation meetings relating to EMS and EU Forum for Accreditation Bodies EMAS meetings.. For two years she was a board member of the International Emissions Trading Association (IETA), she chaired their working group on accreditation of operational entities, and she represents LR as a NGO at Kyoto meetings.

On a personal level she was elected member of The Institute of Energy Council and Executive Committee for 5 years, actively supported the development of the Engineering Council's "Guidelines on Environmental Issues" and participated on the judging panel for the Engineering Council's Environmental Award and she has acted as mentor to individuals during their management courses and MSc in Environmental Change.

#### QUALIFICATIONS

ACADEMIC	MSc, DIC PhD, MBA	
PROFESSIONAL	Chartered Engineer	
	MEI	Member Energy Institute
	MIMgt	Member Institute of Management
	Affiliate	Institution of Chemical Engineers
	MIEMA	Member Institute Environmental Management and
	Assessment	
	EARAVIEMA	Principal Environmental Auditor and Principal EMS Auditor
	UKAS	Lead Verifier for EMAS (since 10 July 1995)
	Affiliate	Institute of Social and Ethical AccountAbility

## PROFESSIONAL EXPERIENCE

1989- 1995

LLOYD'S REGISTER

Dates

Dr Warris was Manager of Environmental Assurance and Integrated Services within Lloyd's Register (LR), with responsibility for development of corporate business and maintenance of technical standards of all Environmental Assurance worldwide activities, finance and business planning, staff recruitment and management as well as strategic and specific direction of marketing activities.

She has acted as project director and manager on a wide range of projects especially associated with audits, verification and validation of environmental reports and pre-acquisition audits.

1984-1989

Babcock Power Limited

Anne-Marie's work concentrated on the development of low NO<sub>x</sub> prediction methodology including tests, complex mathematical combustion models and support for the low NO<sub>x</sub> burner development associated with large fossil fuel fired steam generating boiler plants. The work involved presentations to clients and liaison with internal and external bodies.

1983-1984

Imperial College – research associate

Dr Warris was a post doctoral researcher at the Chemical Engineering and Technology Department and the Mechanical Engineering Department carrying out work on the use of small plasma jets for ignition of pulverised coal streams. This followed on naturally from her Ph.D. research into use of plasma jets to ignite fast flowing gaseous streams.

## PUBLICATIONS

Can be provided on request

## LANGUAGES

Fluent Swedish and Danish, spoken French and some German