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# VALIDATION REPORT

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## LOMA LOS COLORADOS LANDFILL GAS PROJECT IN CHILE

REPORT No. 2006-0496

REVISION No. 001

DET NORSKE VERITAS



## VALIDATION REPORT

Date of first issue: 2006-03-21	Project No.: 45010036
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### Summary:

Det Norske Veritas Certification Ltd. (DNV) has performed a validation of the “Loma Los Colorados Landfill Gas Project” in Chile on the basis of UNFCCC criteria for the CDM, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM Executive Board.

The validation consisted of the following three phases: i) a desk review of the project design documents, ii) follow-up interviews with project stakeholders and iii) the resolution of outstanding issues and the issuance of the final validation report and opinion.

In summary, it is DNV’s opinion that the “Loma Los Colorados Landfill Gas Project” as described in the PDD of 18 December 2006 meets all relevant UNFCCC requirements for the CDM and correctly applies the baseline and monitoring methodology ACM0001 version 4. Hence, DNV requests the registration of the “Loma Los Colorados Landfill Gas Project” as a CDM project activity.

Report No.: 2006-0496		Subject Group: Environment	
Report title: Loma Los Colorados Landfill Gas Project, Chile			
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Date of this revision: 2006-12-18	Rev. No.: 01	Number of pages: 10	

<b>Indexing terms</b>	
Key words Climate Change Kyoto Protocol Validation Clean Development Mechanism	Service Area Validation
	Market Sector
	Waste handling and disposal Industry
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***Abbreviations***

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CL	Clarification request
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
DNV	Det Norske Veritas
DNA	Designated National Authority
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
LoA	Letter of Approval
LFG	Landfill gas
MP	Monitoring Plan
NGO	Non-governmental Organisation
ODA	Official Development Assistance
PDD	Project Design Document
SIC	Central Interconnected System of Chile.
UNFCCC	United Nations Framework Convention on Climate Change



## 1 INTRODUCTION

MGM International, Inc. has commissioned Det Norske Veritas Certification Ltd. (DNV) to validate the “Loma Los Colorados Landfill Gas Project” in Chile (hereafter called “the project”). This report presents the findings of the validation of the project, performed on the basis of UNFCCC criteria for CDM projects, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The validation team consisted of the following personnel:

Mr Michael Lehmann	DNV Certification Norway	Team leader, CDM validator
Ms Mathsy K	DNV Certification, Bangalore	GHG auditor (training)
Mr Filipe Tavares	DNV Certification Brazil	Waste expert, GHG auditor
Mr Miguel Rescalvo	DNV Certification Norway	Technical reviewer (acting)
Mr. Einar Telnes	DNV Certification Norway	Technical reviewer

### 1.1 Validation Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design, as documented, is sound and reasonable and meets the identified criteria. 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).

### 1.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodologies ACM0001 version 04 and ACM0002 version 06. The validation team has, based on the recommendations in the Validation and Verification Manual /7/ employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

### 1.3 Description of Proposed CDM Project

The Loma Los Colorados landfill gas project proposes the installation of a landfill gas collection and flaring system in conjunction with an electricity generation system at the Loma Los Colorados landfill in Chile.

The landfill started accepting waste in April 1996 and the site is currently operating a small LFG collection and flaring system. The project activity achieves emission reductions by



capturing and flaring landfill gas, which would have been released into the atmosphere in the absence of this project activity. The total emission reductions from the project are estimated to be on the average 582,425 tCO<sub>2</sub>e/year over the 7 year renewable crediting period.

## 2 METHODOLOGY

The validation consisted of the following three phases:

- I a desk review of the project design, the baseline and monitoring plan,
- II follow-up interviews with project stakeholders,
- III the resolution of outstanding issues and the issuance of the final validation report and opinion.

In order to ensure transparency, a validation protocol was customised for the project, according to the Validation and Verification Manual /7/. The protocol shows in transparent manner criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described in Figure 1.

The completed validation protocol for the “Loma Los Colorados Landfill Gas Project” is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfilment of validation protocol criteria or where a risk to the fulfilment of project objectives is identified. Corrective action requests (CAR) are issued, where:

- i) mistakes have been made with a direct influence on project results;
- ii) validation protocol requirements have not been met; or
- iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

The term clarification may be used where additional information is needed to fully clarify an issue.



<b>Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities</b>			
<b>Requirement</b>	<b>Reference</b>	<b>Conclusion</b>	<b>Cross reference</b>
<i>The requirements the project must meet.</i>	<i>Gives reference to the legislation or agreement where the requirement is found.</i>	<i>This is either acceptable based on evidence provided (OK), a <b>Corrective Action Request (CAR)</b> of risk or non-compliance with stated requirements or a request for <b>Clarification (CL)</b> where further clarifications are needed.</i>	<i>Used to refer to the relevant checklist questions in Table 2 to show how the specific requirement is validated. This is to ensure a transparent Validation process.</i>

  

<b>Validation Protocol Table 2: Requirement Checklist</b>				
<b>Checklist Question</b>	<b>Reference</b>	<b>Means of verification (MoV)</b>	<b>Comment</b>	<b>Draft and/or Final Conclusion</b>
<i>The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in seven different sections. Each section is then further sub-divided. The lowest level constitutes a checklist question.</i>	<i>Gives reference to documents where the answer to the checklist question or item is found.</i>	<i>Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable.</i>	<i>The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached.</i>	<i>This is either acceptable based on evidence provided (OK), or a <b>Corrective Action Request (CAR)</b> due to non-compliance with the checklist question (See below). A request for <b>Clarification (CL)</b> is used when the validation team has identified a need for further clarification.</i>

  

<b>Validation Protocol Table 3: Resolution of Corrective Action Requests and Requests for Clarification</b>			
<b>Draft report corrective action requests and requests for clarifications</b>	<b>Ref. to Table 2</b>	<b>Summary of project participants' response</b>	<b>Final conclusion</b>
<i>If the conclusions from the draft Validation are either a <b>Corrective Action Request</b> or a <b>Clarification Request</b>, these should be listed in this section.</i>	<i>Reference to the checklist question number in Table 2 where the <b>Corrective Action Request</b> or <b>Clarification Request</b> is explained.</i>	<i>The responses given by the project participants during the communications with the validation team should be summarised in this section.</i>	<i>This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion".</i>

**Figure 1 Validation protocol tables**



## 2.1 Review of Documents

The Project Design Document /1/, version 4 of 18 December 2006, its previous versions and other supporting documents /3/ /6/ submitted by MGM International, Inc. together with additional background documents related to the project design and baseline /7/ /10/ were reviewed during the validation.

## 2.2 Follow-up Interviews

During the validation process DNV performed interviews on 13 March 2006 and 1 December 2006 with project stakeholders (MGM International and KDM) to confirm selected information and to resolve issues identified in the document review.

## 2.3 Resolution of Clarification and Corrective Action Requests

The objective of this phase of the validation is to resolve any outstanding issues which need to be clarified for DNV's positive conclusion on the project design.

The initial findings of the validation were presented to the project developer in a draft validation report dated 21 March 2006. The project participant's response to DNV's preliminary findings, which also included the submission of a revised PDD addressed all preliminary findings to DNV's satisfaction.

## 2.4 Internal Quality Control

The draft validation report including the initial validation findings underwent a technical review before being submitted to the project participants. The final validation report underwent another technical review before requesting registration of the project activity. The technical review was performed by a technical reviewer qualified in accordance with DNV's qualification scheme for CDM validation and verification.





### 3 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A.

The final validation findings relate to the project design as documented and described in the revised PDD of 18 December 2006.

#### 3.1 Participation Requirements

The only project participant is KDM S.A. of Chile. The host Party, Chile ratified the Kyoto Protocol on 26 August 2006 and meets all relevant participation requirements. The Chilean DNA provided approval of voluntary participation on 27 November 2006 /2/ and confirmed the project assistance to the sustainable development of the country.

#### 3.2 Project Design

The project activity involves installation of a landfill gas capture and flaring system at the Loma Los Colorados landfill site. This captured LFG is partly flared and partly used for energy generation. The landfill site covers a total area of 800 hectare (ha) and started operation in April 1996. More than 16.3 million tonnes of waste have been filled over 48.5 of the landfill's 200 hectares. The MSW is delivered at an average of ca. 5000 tonnes per day. The landfill is predicted to reach its final capacity by 2045.

The technology to be employed includes a landfill gas collection system consisting of a gas collection system, airtight covering of the landfill and flaring equipment. The landfill gas collection system uses state of the art gas collection technology which consists of vertical wells to extract the gas. The vertical wells are connected to the gas collection system which consists of interconnected pipes throughout the landfill.

The project proposes the generation of electricity using the landfill gas captured. The initial installed capacity is expected to be 0.8MW to cover the internal demand and it is planned to increase the installed capacity up to the limit authorized in the environmental authorization /6/ of 3MW.

The project activity is expected to be commissioned on 01 December 2006 and the expected operational lifetime of the project is 21 years. A renewable crediting period has been selected starting on 1 March 2007.

The project is expected to aid sustainable development in the host country through reducing methane emissions and minimizing the risk of explosions at the site. A transfer of technology and specialized operators is required for project's implementation and operation, which implies positive impacts on the employment and construction capacity skills.

No public funding is involved in the project, and the validation did not reveal any information indicating the project can be seen as a diversion of ODA funding towards Chile.



### 3.3 Baseline Determination

The project applies the approved consolidated baseline methodology ACM0001 version 04 of 28 July 2006 – *Consolidated baseline methodology for grid-connected electricity generation from biomass residues* /9/. This methodology is applicable to project activities that reduce greenhouse gas emissions through landfill gas capture and destruction of the methane by flaring and/or generation of electricity. In the case of “Loma Los Colorados Landfill Gas Project”, the destruction of methane includes capture and utilisation of landfill gas for generation of electricity and flaring of the surplus amount.

The selected baseline scenario is the partial flaring of the landfill gas. From 1998 a small amount of biogas has been burnt. The data of flared biogas in these nine years do not show any specific trend and thus the selection as baseline scenario of flaring an equivalent amount of landfill gas to the average biogas flared for the last three years (2002-2004) is considered appropriate (i.e. 245 tonnes CH<sub>4</sub>/year). The landfill was authorized by the RCA 1033 of 1995, the landfill operation EIA was approved by resolution 990 of 1995 and the biogas utilization project was granted the environmental authorization by resolution RCA 391 of 2006, those resolutions do not include any obligation of flaring biogas. It can thus be concluded that the Loma Los Colorados landfill does not have any contractual or legal obligation to flare biogas. The chosen baseline presented is thus deemed reasonable and transparent.

### 3.4 Additionality

In accordance with ACM0001, the additionality of the project is demonstrated through the *Tool for the demonstration and assessment of additionality*, which includes the following steps:

Step 0 -Preliminary screening based on the starting date of the project activity: The project start date and the start date of the crediting period is 01 March 2006, which is after the validation date. Hence, step 0 is not applicable.

Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations: The identified alternative scenarios to proposed project activity inline with the current legal and regulatory requirements include:

- a) Continuation of release of the LFG into the atmosphere, with only certain amounts being captured and flared as the case was since 1998.
- b) Implementation of the project activity without CDM incentives.

Step 2 - Investment analysis: The project activity applies an investment analysis. The project proponent has considered two parts for the investment analysis viz.: (a) landfill gas capture and flaring and (b) electricity generation using LFG.

As the CDM project activity does not generate any financial or economic benefits other than CDM related income, the simple cost analysis scenario is applied. The required investment has been assessed /4/ to amount to US\$ 5,559,248 for the years 2006 and 2007, for the flaring option only.

For analyzing the financial performance when selling electricity to the grid, an IRR analysis has been done /4/ resulting in a negative IRR of -0.75%. A sensitivity analysis has been carried out by decreasing the expected investment by 20%, increasing the operating



and maintenance costs by 20% and increasing the electricity sale price by 20%. In the best case the IRR reaches 4.08%, which is below the commonly benchmark used in Chile of 10%.

Step 3 - Barrier analysis: The two barriers identified to the project activity include technological barrier and barriers due to prevailing practices. Since the project involves implementation of a new technology availability of skilled and/or properly trained labour to operate and maintain the technology is not available. Lack of infrastructure for implementation of the technology has posed another barrier to project activity. The regulations in Chile currently do not mandate capture and flaring of the LFG.

Step 4 - Common practice analysis: It has been demonstrated that at the time of submitting the PDD for validation and without taking into account other CDM projects, no other activities were currently in operation in Chile similar to the proposed project activity.

Step 5 - Impact of CDM registration: CER revenues alleviate the economic and financial hurdles of the project thus helping implementation of the project activity. The registration of this project as a CDM project will also attract new players into this field, thus accelerating the implementation of such projects in Chile.

In conclusion, it has been verified that the project is not financially attractive and faces different barriers and thus is not the most likely baseline scenario. Hence, the emissions reduction is additional to those that would occur without the project implementation.

### 3.5 Monitoring Plan

The project correctly applies the approved monitoring methodology ACM0001 version 04-*“Consolidated monitoring methodology for landfill gas projects activities”*.

The monitoring methodology is applicable as the project activity envisages the capturing and flaring and use of some of the captured landfill gas for energy generation. In line with the methodology the project will monitor the following parameters.

- Landfill gas captured, flared and combusted in the power plant using flow meters. The minimum value between the landfill captured and the sum of the biogas flared and used for electricity generation is proposed to be used for the calculation of emissions reduction. This is in line with the methodology.
- Flare efficiency – measurement of time of operation and flue gas analysis. Yearly monitoring of the enclosed flared.
- Landfill gas composition – analysis
- Landfill gas temperature and pressure – measured.
- Electricity consumption for the project, electricity exported to the grid and hours of operation of the power plant.
- The changes in the regulations will be monitored. The monitoring plan also includes the monitoring of the environmental indicators required by the environmental authorization of the project /6/.

All the data will be archived for two years after the crediting period.



The characteristics of the monitoring equipment are detailed in the PDD and are considered correct. The monitoring equipment are planned to be calibrated by accredited entities and the timing is defined in the PDD. Training in monitoring practices will be provided by the technology suppliers. The responsibilities for monitoring and the operational and management structure are well defined and are considered adequate.

### 3.6 Calculation of GHG Emissions

The emission reductions are directly monitored and calculated *ex-post*, using the approach indicated in the methodology ACM0001 version 04. This methodology calls for applying the methodology ACM0002 for the calculation of the grid emission factor.

For the *ex-ante* estimation of emission reductions, the expected LFG generation is forecasted using IPCC's guidelines and an SCS Engineers in-house model that employs a first-order decay equation identical to the algorithm in the U.S. Environmental Protection Agency (EPA) landfill gas emissions model (LandGEM). The following values have been used:

Capture capacity: 60% for the estimation of methane to be destroyed in the baseline. 50% for estimation of methane flared under the project activity. This approach is considered conservative.

Content of methane in the biogas: 50%

Flare efficiency: 98%. Data from the manufacturer provider.

The variables  $L_0 = 80.64 \text{ m}^3\text{CH}_4/\text{ton waste}$  and  $k = 0.070$  are adequate for the dry conditions of the landfill and estimated in line with the IPCC guidelines.

As pointed out in section 3.2 above, the LFG flared in the baseline is established as the average LFG flared during the years 2002-2004 i.e. 245 tonnes  $\text{CH}_4/\text{year}$ . This is estimated applying a 60% recovery rate and a flare efficiency of 100%, which is deemed conservative.

The emission reduction from power generation is calculated as the product of net quantity of electricity exported to the grid and the grid emission factor. The internal demand is foreseen to be 55.93 kWh per 5000  $\text{m}^3$  of LFG. The emissions due to the electricity utilization when the project does not generate electricity on sit are calculated applying an emission factor of 0.608  $\text{tCO}_2/\text{MWh}$ , this is the operating margin emission factor for the central interconnected system of Chile (SIC) calculated as the simple adjusted operating margin as per ACM0002 for the years 2003, 2004, 2005. The grid emission factor for electricity exports is the combined margin for the SIC grid calculated as the average of the OM and BM emission factors i.e. 0.408  $\text{tCO}_2/\text{MWh}$ . The grid emission factors are calculated based on data from Load Economic Dispatch Center (CDEC) of the Central Interconnected System (SIC) and are fixed *ex-ante* for the entire crediting period. The calculations have been verified and are considered correct.

The estimated emissions reduction is on average 582,425  $\text{tCO}_2/\text{year}$  over the first seven year crediting period. Considering the level of uncertainty related to the methane generation and collection efficiency, which depends on the actual design and engineering of the project, this might be achievable if the project is implemented suitably. 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 of almost 50% and hence the amount of CERs, which will be monitored ex-post, might vary from the projected amount.

### 3.7 Environmental Impacts

An environmental impact study was conducted for the Loma Los Colorados landfill and this was approved by Sistema de Evaluación de Impacto Ambiental, (SEIA) in 1995. KDM S A obtained the permit for the operation of the landfill, with the positive resolution RCA 1033 of 1995, , the landfill operation EIA was approved by resolution 990 of 1995 and the biogas utilization project was granted the environmental authorization by resolution RCA 391 of 2006. The Resolution 391 of 2006 identifies the probable environmental impacts in soil and air during the construction, exploitation and closing phases. The remediation actions the project developer is required to carry out and the required monitoring activities are also included in the regulation. These environmental indicators required to be monitored have been included in the monitoring plan.

Since the project activity involves the capturing and flaring of landfill gas and generation of electricity using the same, no major adverse environmental impacts are expected to occur. The project activity results in positive environmental impacts like reduction in GHG emissions into the atmosphere, reduction in odours, fire and risks associated with explosion due to better management of the landfill site.

### 3.8 Comments by Local Stakeholders

A stakeholder consultation was carried out in two stages. A questionnaire was initially circulated amongst all the potential stakeholders and then there were two public events conducted in August 2005 to invite inputs regarding the proposed project activity.

The project received several comments, most of them favouring the implementation of the project activity. Certain stakeholder raised their concern regarding flaring of the captured landfill gas as wasting useful energy and suggested that the project instead of flaring the captured landfill gas should be used to replace other fuels as a source of useful energy. Some other comments were related to how the project affects the development of the nearby village, Montengro. The project proponents explained that the village would be benefited from the project implementation since it would result in employment of about ten to twelve people and also result in indirect development through the general improvement of the local economy.

## 4 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS

The PDD of 27 January 2006 was made publicly available on DNV's climate change website

([www.dnv.com/certification/climatechange/Projects/ProjectDetails.asp?ProjectId=454](http://www.dnv.com/certification/climatechange/Projects/ProjectDetails.asp?ProjectId=454)) and the Parties, stakeholders and NGOs were through the CDM website invited to provide comments during a 30 days period from 25 January 2006 to 23 February 2006.

One comment was received on 14 February 2006. The comment received (in unedited form) is given in the below text box



**Comment by:** [Francisco Acuña, Eratech Chile Ltda.](#)

**Inserted On:** 2006-02-14

**Subject:** Additionality Concern

**Comment:** Lomas los Colorados Landfill Environmental Impact Assessment (EIA) was approved by the local DNA (CONAMA) under Resolution N° 990 June 27th 1995 Spanish language copy available at: [www.e-seia.cl/seia-web/ficha/fichaProceso.php?id\\_expediente=1033&idExpediente=1033](http://www.e-seia.cl/seia-web/ficha/fichaProceso.php?id_expediente=1033&idExpediente=1033). Annex 1 section 1 specify the mandatory long term monitoring program for the LFG system's active capture. How this mandatory regulation is compatible with the project's additionality? How many active capture's wells was proposed at the original 1995 's EIA? Only twelve of them were mentioned at the PDD.

#### **How the project developer considered the comment received**

The answer provided by the project developer (in unedited form) is given in the below text:

*Answer: Annex 1 of the Resolution N° 990 June 27th 1995, mentioned above, describes the demand for monitoring wells, which should be installed around the perimeter of every landfill for safety purposes. CONAMA (Metropolitan Region) issued the approval ("RCA") of the environmental permit for this CDM project development on July 28, 2006.*

*[http://www.e-seia.cl/expediente/ficha/publica/documentos.php?id\\_expediente=1220419&idExpediente=1220419](http://www.e-seia.cl/expediente/ficha/publica/documentos.php?id_expediente=1220419&idExpediente=1220419).*

*This approval confirms that KDM is complying with the regulations in reference to the amount of gas vented. There is no mention of active wells for LFG collection in the EIA.*

The project developer's answer to DNV request for clarification CL3 is reproduced here as being representative to this matter:

*Loma Los Colorados was the first landfill in Chile that voluntarily entered into the Environmental Impact Evaluation System (Sistema de Evaluación de Impacto Ambiental, SEIA) in 1995. As result of this evaluation by the authorities, the Environmental Impact Study (EIS) submitted by Kenbourne Ingeniería Ambiental S.A. (by then the owner of the landfill) stated their commitment of just collecting the landfill gas and venting it to the atmosphere but in no case flaring it. The real objective of this commitment was to prevent the migration of landfill gas to the ground water and polluting it with the soluble parts of LFG. Moreover, the Resolution of Environmental Qualification Resolution (RCA, in Spanish) issued by the environmental authorities and the only mandatory document only required LFG monitoring at key points of the landfill e.g. the perimeter and the vent wells what has been done regularly every three months. Such monitoring has been conducted regularly every three months. On a voluntary basis, KDM's installed a limited flaring system in 1998, and started its operation on a non-regular basis. (Source: <http://www.e-seia.cl/documentos/documento.php?idDocumento=1506593> in item 1.1.7.b).*



*Additionally, the same document, page 5, second paragraph, tatus “Hasta el momento esta comprometida la extracción de biogás para controlar principalmente los aumentos de presión interna del Relleno Sanitario y riesgos de acumulaciones puntuales que podrían dar paso a una inflamación superficial no deseada, objetivos que se cumplen con las cantidades de biogás actualmente captadas.” Translation: “So far, the commitment to extract landfill gas mainly for increases in the internal pressure of the sanitary landfill and the risks of local build up (of LFG) which could lead to an undesirable surface fire. These objectives are met with the quantity of LFG currently captured”.*

### **How DNV has considered the comment received in its validation**

DNV has verified that the project was granted the operation permit (RCA 1033/995) and environmental authorizations (RCA 990/1995 and RCA 391/2006). The resolution RCA 391/2006 acknowledges there are 12 wells connected to a flare station and includes the amount of methane flared from 1998. The data are in line with those in the PDD. The Loma Los Colorados landfill has been verified not to have any environmental sanction (01 December 2006 [www. http://www.e-seia.cl](http://www.e-seia.cl)). It has been also verified that the resolution RCA 990/1995 does not include any specific reference to an amount of LFG to be flared. In conclusion, it is DNV opinion that the landfill description in the PDD is in line with the basis included in the resolution RCA 391/2006 and that the baseline situation is thus appropriate.





## 5 VALIDATION OPINION

*Det Norske Veritas Certification Ltd. (DNV) has performed a validation of the “Loma Los Colorados Landfill Gas Project” in Chile. The validation was performed on the basis of UNFCCC criteria for CDM project activities and relevant Chilean criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.*

*The project participant is KDM S.A. of Chile. The host Party Chile meets all relevant participation requirements. The DNA of Chile has confirmed the project contribution to the sustainable development of the country.*

*The project objective is to capture and flare the landfill gas produced at Loma Los Colorados Landfill, along with generation of electricity with some amount of landfill gas captured to avoid emissions of methane to the atmosphere. The technology to be employed will be the improvement of landfill gas collection and flaring, through the installation of a highly efficient active recovery system composed by a collection and transportation pipeline network and a flaring system.*

*The project applies the approved baseline and monitoring methodology ACM0001 version 04, i.e. “Consolidated baseline and monitoring methodology for landfill gas project activities”. The baseline methodology has been correctly applied and the assumptions made for the selected baseline scenario are sound. It is sufficiently demonstrated that the project is not a likely baseline scenario and that emission reductions attributable to the project are additional to any that would occur in the absence of the project activity.*

*The monitoring methodology has been correctly applied. The monitoring plan sufficiently specifies the monitoring requirements.*

*By burning of landfill gas the project results in reductions of CH<sub>4</sub> emissions that are real, measurable and give long-term benefits to the mitigation of climate change. The estimated emissions average reduction is 582,425tCO<sub>2</sub>/year over the first seven year crediting period. Considering the level of uncertainty related to the methane generation and collection efficiency, which depends on the actual design and engineering of the project, this might be achievable if the project is implemented as designed. 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 of almost 50% and hence the amount of actual emissions reduction, which will be monitored ex-post, might vary from the projected amount.*

*The local stakeholder consultation was carried out by KDM. Comments by Parties, stakeholders and NGOs were also invited via the UNFCCC web-site and the comments received were taken into account in the validation.*

*In summary, it is DNV’s opinion that the “Loma Los Colorados Landfill Gas Project”, as described in the revised and resubmitted project design document of 18 December 2006, meets all relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies the baseline and monitoring methodology. Given that the project is implemented as described, the estimate for the anticipated emission reductions stated in the project design document is reasonable and likely to be achieved. Hence, DNV requests the registration of the “Loma Los Colorados Landfill Gas Project” as a CDM project activity.*





## REFERENCES

*Documents provided by the project proponent that relate directly to the project:*

- /1/ MGM International: CDM-PDD for “Loma Los Colorados Landfill Gas Project”, version 4 of 18 December 2006
- /2/ Letter of Approval. DNA of Chile. 27 November 2006.
- /3/ Grid emission factor calculation:  
Chile\_SIC Emission Factor\_Los Colorados 12dec06.pdf
- /4/ Financial analysis:  
LLC Econ and sensitivity LFG capture power gen 10dec06.pdf
- /5/ LFG generation model:  
Loma Los Colorados\_LFG & CER Estimation\_18Dec06.pdf
- /6/ Landfill operation permit and environmental authorizations:  
Resolution RCA 1033 of 1995  
Resolution RCA 990 June 27th 1995  
Resolution RCA 391 of 28 July 2006

*Background documents related to the design and/or methodologies employed in the design or other reference documents:*

- /7/ International Emission Trading Association (IETA) & the World Bank’s Prototype Carbon Fund (PCF): *Validation and Verification Manual*, <http://www.vvmanual.info>
- /8/ CDM-EB: ACM0001 - *Consolidated baseline/monitornig methodology for landfill gas project activities*, version 04.
- /9/ CDM-EB: ACM0002 - *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, version 06.
- /10/ CDM-EB: *Tool for the demonstration and assessment of additionality*“, version 02, 28 November 2005.

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## **APPENDIX A**

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### **CDM VALIDATION PROTOCOL**

**Table 1 Mandatory Requirements for Clean Development Mechanism (CDM) Project Activities**

Requirement	Reference	Conclusion	Cross Reference / Comment
1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3	Kyoto Protocol Art.12.2	NA	Annex I Party has not been identified yet.
2. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof	Kyoto Protocol Art. 12.2, CDM Modalities and Procedures §40a	<del>GAR-4</del>	Table 2, Section A.3 This has been confirmed by the DNA of Chile. The Chilean DNA granted the LoA on 27 November 2006.
3. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC	Kyoto Protocol Art.12.2.	OK	Table 2, Section E.4.1
4. The project shall have the written approval of voluntary participation from the designated national authority of each party involved	Kyoto Protocol Art. 12.5a, CDM Modalities and Procedures §40a	<del>GAR-4</del>	The letter of approval of DNA of Chile was obtained on 27 November 2006.
5. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change	Kyoto Protocol Art. 12.5b	OK	Table 2, Section E
6. Reduction in GHG emissions shall be additional to any that would occur in absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity	Kyoto Protocol Art. 12.5c, CDM Modalities and Procedures §43	OK	Table 2, Section B.2
7. In case public funding from Parties included in Annex I is used for the project activity, these Parties shall provide an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of these Parties	Decision 17/CP.7, CDM Modalities and Procedures Appendix B, § 2	OK	No public funding involved. The validation did not revealed any information that indicates the project can be seen as

Requirement	Reference	Conclusion	Cross Reference / Comment
			a diversion of ODA funding towards Chile.
8. Parties participating in the CDM shall designate a national authority for the CDM	CDM Modalities and Procedures §29	OK	CONAMA is the Designated National Authority in Chile.
9. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol	CDM Modalities §30/31a	OK	Chile ratified the Kyoto Protocol on 26 August 2002. Annex I Party has not been identified yet.
10. The participating Annex I Party's assigned amount shall have been calculated and recorded	CDM Modalities and Procedures §31b	NA	Annex I Party has not been identified yet.
11. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto Protocol Article 5 and 7	CDM Modalities and Procedures §31b	NA	Annex I country has not been identified yet.
12. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received	CDM Modalities and Procedures §37b	OK	Table 2, Section G
13. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out.	CDM Modalities and Procedures §37c	OK	Table 2, Section F
14. Baseline and monitoring methodology shall be previously approved by the CDM Executive Board	CDM Modalities and Procedures §37e	OK	Table 2, Section B.1.1 and D.1.1
15. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP	CDM Modalities and Procedures §37f	OK	Table 2, Section D

Requirement	Reference	Conclusion	Cross Reference / Comment
16. Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available	CDM Modalities and Procedures §40	OK	The project was web hosted on the DNV website ( <a href="http://www.dnv.com/certification/climatechange/Projects/ProjectDetails.asp?ProjectId=454">http://www.dnv.com/certification/climatechange/Projects/ProjectDetails.asp?ProjectId=454</a> ) between 25 January 2006 to 23 February 2006, for the 30 day stakeholder comments. One comment was received on the 14 February 2006.
17. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances	CDM Modalities and Procedures §45c,d	OK	Table 2, Section B.2
18. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or due to force majeure	CDM Modalities and Procedures §47	OK	Table 2, Section B.2
19. The project design document shall be in conformance with the UNFCCC CDM-PDD format	CDM Modalities and Procedures Appendix B, EB Decision	GAR-2	Yes.

**Table 2 Requirements Checklist**

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>A. General Description of Project Activity</b> <i>The project design is assessed.</i>					
<b>A.1. Project Boundaries</b> <i>Project Boundaries are the limits and borders defining the GHG emission reduction project.</i>					
A.1.1. Are the project's spatial (geographical) boundaries clearly defined?	/1/	DR	Yes, Loma Los Colorados landfill is located in the commune of Til-Til. It is 3 km from Montenegro village. 63.5km North of Santiago de Chile.		OK
A.1.2. Are the project's system (components and facilities used to mitigate GHGs) boundaries clearly defined?	/1/	DR	The project's system boundary includes the physical site of the project activity where the LFG is captured and flared and the electricity generated.  The grid electricity system selected for the determination of the emission coefficient applied to determine emission reductions from displacing grid electricity is the Central Interconnected System of the Republic of Chile (SIC).		OK
<b>A.2. Technology to be employed</b> <i>Validation of project technology focuses on the project engineering, choice of technology and competence/ maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.</i>					
A.2.1. Does the project design engineering reflect	/1/	DR	The project's design engineering reflects	GL-1	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
current good practices?			current good practice by installing vertical wells, pipes to the blower and a flare. The existing collecting and flaring system will be partially expanded and improved. Also, a leachate treatment unit and a condensate management system will be installed. Further information is requested about the electricity generation facility and the consumption of electricity on site (need of 0.8 MW of installed capacity). It is not stated how the project developer can expect to sell the electricity produced to the grid (contracts with SIC, authorizations).		
A.2.2. Does the project use state of the art technology or would the technology result in a significantly better performance than any commonly used technologies in the host country?	/1/	DR	Yes, common practice in Chile is not to capture gas. Therefore, the project will result in better performance as compared to the common practice.		OK
A.2.3. Is the project technology likely to be substituted by other or more efficient technologies within the project period?	/1/	DR	The project technology is not likely to be substituted within the crediting period.		OK
A.2.4. Does the project require extensive initial training and maintenance efforts in order to work as presumed during the project period?	/1/	DR	Yes. The operation and maintenance of the capture and utilization equipment requires some expertise in order to generate the forecast amount of emission reductions.		OK
A.2.5. Does the project make provisions for meeting training and maintenance needs?	/1/	DR	The PDD states that KDM S.A. is responsible for the operation of the site but there is no information about training requirements, qualifications and how they are expected to be covered.	GL-2	OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>A.3. Contribution to Sustainable Development</b> <i>The project's contribution to sustainable development is assessed.</i>					
A.3.1. Is the project in line with relevant legislation and plans in the host country?	/1/	DR, I	The project proponent is requested to submit relevant permits and licences for construction and operation of the project. It needs to be clarified if the EIA of Loma Los Colorados landfill was approved under the assumption that part of LFG was expected to be flared.	<del>GL-3</del>	OK
A.3.2. Is the project in line with host-country specific CDM requirements?	/1/	DR	This can be concluded only after the host country approval is submitted to DNV.	<del>CAR-1</del>	OK
A.3.3. Is the project in line with sustainable development policies of the host country?	/1/	DR	This can be concluded only after the host country approval is submitted to DNV.	<del>CAR-1</del>	OK
A.3.4. Will the project create other environmental or social benefits than GHG emission reductions?	/1/	DR	Yes, the project is expected to have other Sustainable development benefits such as: <ul style="list-style-type: none"> <li>▪ Reducing fire and explosion risks.</li> <li>▪ Reducing air pollutants and odours.</li> <li>▪ Use of clean and efficient technologies.</li> <li>▪ Act as a clean technology demonstration project.</li> </ul>		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview



Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>B. Project Baseline</b> <i>The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.</i>					
<b>B.1. Baseline Methodology</b> <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
B.1.1. Is the baseline methodology previously approved by the CDM Executive Board?	/1/	DR	Yes, the project adopts the approved consolidated baseline methodologies ACM0001 - "Consolidated baseline methodology for landfill gas project activities" (version 4) in combination with ACM0002 "Consolidated baseline methodology for grid-connected power generation from renewable sources" (version 6).		OK
B.1.2. Is the baseline methodology the one deemed most applicable for this project and is the appropriateness justified?	/1/	DR	Yes, the baseline methodology is applicable to the proposed project activity as the baseline is the partial atmospheric release of the gas and the project activity involves flaring of the captured LFG and partially utilising it to generate electricity. ACM002 is used as baseline methodology for determining the electricity grid emission coefficient.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>B.2. Baseline Determination</b> <i>The choice of baseline will be validated with focus on whether the baseline is a likely scenario, whether the project itself is not a likely baseline scenario, and whether the baseline is complete and transparent.</i>					
B.2.1. Is the application of the methodology and the discussion and determination of the chosen baseline transparent?	/1/	DR	<p>Yes, baseline scenario has been established as the current practice of capturing and flaring a limited proportion of LFG. Actual data from a monitoring system in place have been used to calculate current emissions reduction. The baseline has been established as the flaring of 245 tonnes CH<sub>4</sub>/year.</p> <p>For the production of electricity the baseline is the production of an equivalent amount of electricity from the current fuel mix used in the SIC (Central Interconnected System of Chile).</p>		OK
B.2.2. Has the baseline been determined using conservative assumptions where possible?	/1/	DR, I	The partial flaring system is in place from 1998. The average amount of methane flared during the years 2002, 2003 and 2004 has been selected as the baseline. The flaring data has been assessed and no specific trend exist thus the selection of the average methane flared for the last three years is considered valid.		OK
B.2.3. Has the baseline been established on a project-specific basis?	/1/	DR	Yes.		OK
B.2.4. Does the baseline scenario sufficiently take into account relevant national and/or sectoral	/1/	DR	Yes. There are currently no national/sectoral policies applicable to the		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
policies, macro-economic trends and political aspirations?			landfill site or the proposed project activity.		
B.2.5. Is the baseline determination compatible with the available data?	/1/	DR	Available data have been used for waste disposal from 1996 and LFG flared from 1998. It should be clarified why IPCC and not local data (net calorific value, factor emission) have been used for the calculation of the emissions of the plants used to calculate the operating margin.	<del>CL4</del>	OK
B.2.6. Does the selected baseline represent the most likely scenario among other possible and/or discussed scenarios?	/1/	DR	Yes, in the absence of the proposed CDM project activity, two other alternatives have been identified: - Continuation of current practice. - Proposed project activity not undertaken as CDM. It is, capture of landfill gas, flaring and using as energy.		OK
B.2.7. Is it demonstrated/justified that the project activity itself is not a likely baseline scenario?	/1/	DR	Yes, the project additionality is demonstrated through the latest version of the <i>"Tool for the assessment and demonstration of additionality"</i> . STEP 0: Step 0 is not applicable as the crediting period starts after the registration of the project upon the CDM Executive Board. However, the starting date of the crediting period needs to be revised (see C.1.2). STEP 1: The project identifies two possible baseline scenarios. Firstly, continuation of current practice of partially flaring LFG and secondly, proposed project activity not undertaken as CDM. Both scenarios are in	<del>CAR-3</del> <del>CL3</del>	OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			<p>line with legal requirements in Chile.</p> <p>STEP 2: The project proponent conducted a project IRR analysis which resulted in an IRR of -0.75%. A sensitive analysis was carried out assuming 20% decrease in the investment, 20% decrease in O&amp;M costs and 20% increase in electricity tariff. In the best case, the IRR reaches 4.08%, below the benchmark rate of 10%. The calculations have been assessed and are considered adequate.</p> <p>STEP 3: A barrier analysis shows that the project activity faces technological barriers and barriers due to prevailing practice.</p> <p>Technology barriers: skilled and/or properly trained labour to operate and maintain the technology is not available and there is a lack of infrastructure for implementation of the technology.</p> <p>Barriers due to prevailing practise: there were no similar projects in Chile at the time of submitting the PDD (with the exception of proposed and registered CDM projects) and, except for the small amount of LFG collected and flared in the current situation, the uncontrolled release of LFG is common practice.</p> <p>STEP 4: Current practice analysis has shown that there is no current or likely future legislation requiring LFG capture and flaring to the extent done by the project.</p>		

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			STEP 5: CER revenues alleviate the economic and financial hurdles of the project. Given above, the project is not a likely baseline scenario and emission reductions are thus additional. However, it needs to be clarified if the EIA of Loma Los Colorados landfill was approved under the assumption that part of LFG was expected to be flared (see A.3.1)		
B.2.8. Have the major risks to the baseline been identified?	/1/	DR	Yes, regulatory requirements relating to landfill gas projects will be monitored.		OK
B.2.9. Is all literature and sources clearly referenced?	/1/	DR	The source of the data used for the calculation of the operating margin and build margin emission coefficient seems to be "anuario 2005" of SDEC-SIC and not "anuario 2004" as stated in page 51 of the PDD.	<del>CL-5</del>	OK
<b>C. Duration of the Project/ Crediting Period</b> <i>It is assessed whether the temporary boundaries of the project are clearly defined.</i>					
C.1.1. Are the project's starting date and operational lifetime clearly defined and reasonable?	/1/	DR	The starting date of the project activity is 1 December 2006 and the operational lifetime of the landfill site is defined as the 21 years.	<del>CL-6</del>	OK
C.1.2. Is the assumed crediting time clearly defined (renewable crediting period of seven years with two possible renewals or fixed crediting period of 10 years with no renewal)?	/1/	DR	The project adopts a renewable crediting period of 7 years. The starting date of the first crediting period shall be revised as the crediting period starting date cannot be before the date of registration of the project as CDM project.	<del>CAR-4</del>	OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>D. Monitoring Plan</b> <i>The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed ((Blue text contains requirements to be assessed for optional review of monitoring methodology prior to submission and approval by CDM EB).</i>					
<b>D.1. Monitoring Methodology</b> <i>It is assessed whether the project applies an appropriate baseline methodology.</i>					
D.1.1. Is the monitoring methodology previously approved by the CDM Executive Board?	/1/	DR	Yes, the project adopts the approved consolidated monitoring methodology ACM0001 version 4.		OK
D.1.2. Is the monitoring methodology applicable for this project and is the appropriateness justified?	/1/	DR	Yes, the monitoring methodology is applicable to the proposed project activity as the baseline is the partial atmospheric release of the gas and the project activity involves flaring of the captured LFG and partly utilising it for electricity generation.		OK
D.1.3. Does the monitoring methodology reflect good monitoring and reporting practices?	/1/	DR	The monitoring plan should include the measurement of the electricity supplied to the grid.	<del>CAR-5</del>	OK
D.1.4. Is the discussion and selection of the monitoring methodology transparent?	/1/	DR	Yes.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
<b>D.2. Monitoring of Emission Reductions</b> <i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>					
D.2.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emission reductions during the crediting period?	/1/	DR	<p>The monitoring of the electricity sold to the grid is required by the methodology and it is not included in the PDD.</p> <p>The monitoring plan includes amount of LFG sold off site. This needs to be revised since the methodology currently does not provide for sale of methane captured.</p> <p>The Project developer is requested to clarify if the grid emission factor is fixed ex-ante or calculate ex-post.</p> <p>The period for which data and records will be archived is not defined.</p>	CAR-5  CL-7  CL-8  CAR-6	OK
D.2.2. Are the choices of indicators reasonable?	/1/	DR	Refer to D.2.1		OK
D.2.3. Will it be possible to monitor / measure the specified indicators?	/1/	DR	Yes		OK
D.2.4. Will the indicators give opportunity for real measurements of project emissions?	/1/	DR	Refer to D.2.1		OK
D.2.5. Will the indicators enable comparison of project data and performance over time?	/1/	DR	Yes		OK
<b>D.3. Monitoring of Leakage</b> <i>It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.</i>					
D.3.1. Does the monitoring plan provide for the collection and archiving of all relevant data	/1/	DR	No leakage occurs.		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
necessary for determining leakage?					
<b>D.4. Monitoring of Sustainable Development Indicators/ Environmental Impacts</b> <i>It is checked that choices of indicators are reasonable and complete to monitor sustainable performance over time.</i>					
D.4.1. Does the monitoring plan provide the collection and archiving of relevant data concerning environmental, social and economic impacts?	/1/	DR	Neither the methodology ACM001 nor the Chilean DNA requires monitoring sustainable indicators. The resolution RCA 391/2006 requires monitoring several environmental and safety indicators. These have been included in the monitoring plan.		OK
<b>D.5. Project Management Planning</b> <i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>					
D.5.1. Is the authority and responsibility of project management clearly described?	/1/	DR	Yes, the responsibility for project management lies with the project operator KDM S.A.		OK
D.5.2. Is the authority and responsibility for registration, monitoring, measurement and reporting clearly described?	/1/	DR	Yes.		OK
D.5.3. Are procedures identified for training of monitoring personnel?	/1/	DR	The PDD states that KDM S.A. is responsible for the operation of the site but there is no information about training requirements, qualifications and how they are expected to be covered.	GL-2	OK
D.5.4. Are procedures identified for emergency	/1/	DR	yes		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
preparedness for cases where emergencies can cause unintended emissions?					
D.5.5. Are procedures identified for calibration of monitoring equipment?	/1/	DR	Some information provided related to the calibration of monitoring equipment should be clarified: Calibration vs. verification of flow meters. Idem gas analyser. Info provided in pages 27 and 28 seems inconsistent. Information about uncertainty, accuracy, range, calibration/verification periods, should be provided with regard to measurement equipments.	<del>CL-9</del>	OK
D.5.6. Are procedures identified for maintenance of monitoring equipment and installations?	/1/	DR	Yes		OK
D.5.7. Are procedures identified for monitoring, measurements and reporting?	/1/	DR	Yes		OK
D.5.8. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation)	/1/	DR	Yes		OK
D.5.9. Are procedures identified for dealing with possible monitoring data adjustments and uncertainties?	/1/	DR	Yes		OK
D.5.10. Are procedures identified for review of reported results/data?	/1/	DR	Yes		OK
D.5.11. Are procedures identified for internal audits of GHG project compliance with operational requirements where applicable?	/1/	DR	Yes		OK
D.5.12. Are procedures identified for project performance reviews before data is submitted for verification, internally or externally?	/1/	DR	Yes		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
D.5.13. Are procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting?	/1/	DR	Yes.		OK
<b>E. Calculation of GHG Emissions by Source</b> <i>It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.</i>					
<b>E.1.GHG Emissions Reduction</b> <i>The validation of ex-ante estimated GHG emissions reduction focuses on transparency and completeness of calculations.</i>					
E.1.1. Are all aspects related to direct and indirect GHG emissions captured in the project design?	/1/	DR	Yes, all aspects related to direct and indirect GHG emission have been captured. The project considers GHG emissions due to the electricity consumed to pump the LFG during the period of time the electricity is not generated on site.		OK
E.1.2. Are the GHG calculations documented in a complete and transparent manner?	/1/	DR	For the <i>ex-ante</i> estimation of emission reductions, the expected LFG generation is forecasted using IPCC's guidelines and an SCS Engineers in-house model that employs a first-order decay equation identical to the algorithm in the U.S. Environmental Protection Agency (EPA) landfill gas emissions model (LandGEM). The following values have been used:  Capture capacity: 60% for the estimation of		OK

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			<p>methane to be destroyed in the baseline. 50% for estimation of methane flared under the project activity. This approach is considered conservative.</p> <p>Content of methane in the biogas: 50%</p> <p>Flare efficiency: 98%. Data from the manufacturer provider</p> <p>There is no evidence of how the project proponent justifies the reliability of the data of municipal waste expected to be delivered to the site.</p> <p>The values used for <math>L_0</math> and K, even when seem adequate, are not justified in the PDD.</p> <p>The LFG flared in the baseline is established as the average LFG flared during the years 2002-2004 i.e. 245 tonnes <math>CH_4</math>/year. This is estimated applying a 60% recovery rate and a flare efficiency of 100% which is deemed conservative.</p> <p>The emission reduction from power generation is calculated as the product of net quantity of electricity exported to the grid and the grid emission factor. The internal demand is foreseen to be 55.93 kWh per 5000 <math>m^3</math> of LFG. The emissions due to the electricity utilization when the project does not generate electricity on sit are calculated applying an emission factor of 0.608 <math>tCO_2/MWh</math>, this is the operating margin emission factor for the central</p>	<p><del>CL-10</del></p> <p><del>CL-11</del></p>	

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Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			<p>interconnected system of Chile (SIC) calculated as the simple adjusted operating margin as per ACM0002 for the years 2003, 2004, 2005. The grid emission factor for electricity exports is the combined margin for the SIC grid calculated as the average of the OM and BM emission factors i.e. 0.408 tCO<sub>2</sub>/MWh. The grid emission factors are calculated based on data from Load Economic Dispatch Center (CDEC) for the Central Interconnected System (SIC)</p> <p>The project developer is requested to clarify if the grid factor is fixed ex ante or updated every year.</p> <p>No leakage has been considered. This is in line with the methodology.</p> <p>The calculations have been verified and are considered correct.</p> <p>The estimated average emissions reduction is 582,425 tCO<sub>2</sub>/year over the first seven year crediting period.</p>	CL-8	
E.1.3. Have conservative assumptions been used when calculating emissions reduction?	/1/	DR	Yes. The assumptions done are described in E.1.2, with the exception of the pending clarification with respect to Lo and K, and are considered conservative.		OK
E.1.4. Are uncertainties in the GHG emission estimates properly addressed in the documentation?	/1/	DR	The main uncertainties are those related to a change in the legislation and those related to the inherent level of uncertainty of the models for the biogas generation estimation. The changes in the legal requirement will be monitored as well as the		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			actual data related to the biogas generation.		
E.1.5. Have all relevant greenhouse gases and source categories listed in Kyoto Protocol Annex A been evaluated?	/1/	DR	Yes		OK
E.1.6. Will the project result in fewer GHG emissions than the baseline scenario?	/1/	DR	The estimated average emissions reduction is 582,425 tCO <sub>2</sub> /year over the first seven year crediting period.		OK
<b>F. Environmental Impacts</b> <i>Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.</i>					
F.1.1. Has an analysis of the environmental impacts of the project activity been sufficiently described?	/1/	DR, I	<p>The project developer is requested to submit to DNV copies of the relevant environmental authorizations.</p> <p>An environmental impact study was conducted for the Loma Los Colorados and this was approved by the Environmental Chilean Commission, in the year 1995 (RCA 990/1995)</p> <p>The project developer obtained the permit for the operation of the landfill, through resolution RCA 1033/1995. The biogas utilization project was granted the environmental authorization by resolution RCA 391 of 2006</p>	<b>CAR 7</b>	OK
F.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?	/1/	DR, I	Since 1994 there is the need to identify environmental impacts for landfills in Chile.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
F.1.3. Will the project create any adverse environmental effects?	/1/	DR	The project is not expected to create any major environmental effects. The Resolution 391 of 2006 identifies the probable environmental impacts in soil and air during the construction, exploitation and closing phases. The remediation actions the project developer is required to carry out and the required monitoring activities are also included in the regulation. These environmental indicators required to be monitored have been included in the monitoring plan.		OK
F.1.4. Are transboundary environmental impacts considered in the analysis?	/1/	DR	There is no such impact.		OK
F.1.5. Have identified environmental impacts been addressed in the project design?	/1/	DR	Yes. refer to F.1.3		OK
F.1.6. Does the project comply with environmental legislation in the host country?	/1/	DR	Yes. Refer to F.1.1		OK
<b>G. Stakeholder Comments</b> <i>The validator should ensure that a stakeholder comments have been invited and that due account has been taken of any comments received.</i>					
G.1.1. Have relevant stakeholders been consulted?	/1/	DR	A focused public consultation process has been performed, surveying the neighbours in the area of direct influence of the project. Leaders of organized local groups in that same area were consulted.		OK
G.1.2. Have appropriate media been used to invite comments by local stakeholders?	/1/	DR	The stakeholder commenting process was carried out through a questionnaire survey sent to all potential stakeholders and two		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

Checklist Question	Ref.	MoV*	Comments	Draft Concl	Final Concl
			public events.		
G.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws?	/1/	DR	There is no local regulation for such activity. Law 19.300 is applicable only as part of an Environmental Impact Assessment. This is not applicable to the project.		OK
G.1.4. Is a summary of the stakeholder comments received provided?	/1/	DR	A summary of the stakeholder comments have been provided in the PDD.		OK
G.1.5. Has due account been taken of any stakeholder comments received?	/1/	DR	Comments are analyzed in the PDD. Reasons for their acceptance/refusal are provided.		OK

\* MoV = Means of Verification, DR= Document Review, I= Interview

**Table 3 Resolution of Corrective Action and Clarification Requests**

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p>CAR 1</p> <p>Letter of approval of the DNA of Chile has not yet been obtained.</p>	<p>Table 1</p> <p>A.3.2</p> <p>A.3.3</p>	<p>Project Environmental Permit was officially approved on July 28<sup>th</sup>, 2006 (see link: <a href="http://www.e-seia.cl/expediente/ficha/publica/documentos.php?id_expediente=1220419&amp;idExpediente=1220419">http://www.e-seia.cl/expediente/ficha/publica/documentos.php?id_expediente=1220419&amp;idExpediente=1220419</a>).</p> <p>Later, on September 12<sup>th</sup>, KDM requested the CDM letter of approval of DNA, which is expected to be issued by the end of September 2006.</p>	<p>OK. The Chilean DNA granted the LoA on 27 November 2006</p> <p>CAR 1 is closed.</p>
<p>CAR 2</p> <p>PDD format should be revised, specifically:</p> <p>1 – Format table page 33, E.6, leakage column to be included (even if 0)</p> <p>2 – Page 32, section E.3 calls for section E.3</p> <p>3 – Formula page 26, build margin.</p>	<p>Table 1</p>	<p>1 – Included in PDD</p> <p>2 – Corrected in PDD</p> <p>3 – Inserted in PDD</p>	<p>OK, CAR 2 is closed.</p>
<p>CAR 3</p> <p>The benchmark for the IRR needs to be provided. Also, the IRR calculation needs to be provided. The project proponent needs to conduct a sensitivity analysis with reasonable variations in critical assumptions.</p>	<p>B.2.7</p>	<p>Included in PDD version 12 December 2006</p>	<p>OK</p> <p>An IRR benchmark of 10% has been chosen, this is adequate for Chile.</p> <p>The sensibility analysis has been done. The investment, O&amp;M costs and electricity tariff have been varied by 20% and the IRR remains below the benchmark. CAR 3 is closed.</p>



Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p><b>CAR 4</b> The starting date of the first crediting period shall be revised as the crediting period starting date cannot be before the date of registration of the project as CDM project.</p>	C.1.2	March 1 <sup>st</sup> , 2007, or following project registration.	OK. CAR 4 is closed.
<p><b>CAR 5</b> The monitoring plan should include the measurement of the electricity supplied to the grid.</p>	D.1.3	Currently included in the PDD, section D.2.2.1 ' <i>Continuous measurement, weekly recording</i> '.	OK Electricity supplied and imported from the grid are included in the monitoring plan. CAR 5 is closed.
<p><b>CAR 6</b> The monitoring plan should establish the period of time data and records will be archived.</p>	D.2.1	Data and records in the monitoring plan will be archived up to 2 years beyond the crediting period.	OK, CAR 6 is closed.

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p>CAR 7</p> <p>The project proponent is requested to submit relevant environmental licences.</p>	F.1.6	<p>KDM's relevant Environmental Licenses:</p> <ul style="list-style-type: none"> <li>• Original EIA with its respective Environmental Qualification Resolution (RCA, in Spanish). There is a printed version of the EIA and an electronic version of the RCA, which corresponds to the approval that the environmental authorities issued to KDM for the landfill operation, in 1995. See "<i><u>RCA_1033_1995_6_27_RE.doc</u></i>", attached.</li> <li>• Environmental permit (Environmental Impact Declaration, DIA in Spanish) submitted by KDM for this CDM Project: "<i>Ampliación del sistema de abatimiento de biogás; sistema de captación, termodegradación y utilización energética, en el marco del Mecanismo para un Desarrollo Limpio, en el Relleno Sanitario Loma Los Colorados</i>". Translation: "Increasing capacity of the LFG control system; capture system, thermal degradation and energy use, within the framework of the Clean Development Mechanism at Loma Los Colorados Sanitary Landfill". This permit was officially approved on July 28<sup>th</sup>, 2006. This document may be downloaded from <a href="http://www.seia.cl">www.seia.cl</a>. For more details, see CAR 1.</li> </ul>	<p>CAR 7 is closed. The landfill permit and environmental authorizations have been verified.</p>

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p>CL 1</p> <p>Further information is requested about the electricity generation facility and the consumption of electricity on site (need of 0.8 MW of installed capacity)</p> <p>It is not stated how the project developer can expect to sell the electricity produced to the grid (contracts with SIC, authorizations).</p>	A.2.1	<p>a. Electricity generation facility. This will most likely consist of:</p> <ul style="list-style-type: none"> <li>• Internal combustion engines, 0.8 – 1.1 MW capacity each, in a number according to the biogas collection.</li> <li>• Electric generator, 0.8 – 1.1 MW capacity each, installed and connected to every engine.</li> <li>• Transformers (from 380 V to about 23 kV), in a number according to the electric power being exported and sold to the grid.</li> <li>• LFG cleaning equipment (if needed, for sulphurs and other corrosive compounds).</li> <li>• Building for housing engines and generators.</li> </ul> <p>b. This facility will cover the on-site electric power demand i.e. 0.8 MW, which comes mainly from the existing leachate treatment plant (this figure can be checked in the attached file "<b>SDOC1050.pdf</b>", if needed).</p>	<p>OK. The project design plans to incorporate electricity generation in different stages with an maximum capacity of 3MW that is the limit authorized. For additional capacity a new permit needs to be granted.</p> <p>The internal demand has been foreseen to be 55.93 kWh per 5000 m<sup>3</sup> of LFG what is considered adequate. CL 1 is closed.</p>

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
		<p>c. Chile has one of the most liberalized, open-access electric power system in the world. There are two laws, Law No. 20,018 and Law No.19,440, which allow the owner of any electricity generation facility to sell energy and power. These laws guarantee the right of any owner of power generation to sell its power electric surplus (energy and power) to the Spot Market at a marginal spot price for energy and a node price for installed capacity. Thus, KDM just needs to send a letter to the SIC (central power grid operator), informing them 3 to 6 months in advance, that it will start generating electricity and sell it to the grid. There are no other requirements for KDM in order to obtain the right for connection to the electricity grid.</p> <p>The current approved environmental permit is limiting KDM to generate up to 3 MW. If KDM deems convenient to go above of 3 MW then another Environment Impact Declaration (DIA) should be submitted to the environmental authorities.</p>	
<p>CL 2</p> <p>The PDD states that KDM S.A. is responsible for the operation of the site but there is no information about training requirements, qualifications and how they are expected to be covered.</p>	<p>A.2.5</p> <p>D.5.3</p>	<p>KDM is a company certified under ISO 9001 and 14001. This means that KDM is obliged to qualify its personnel under rigorous procedures at the beginning of the project and on a monthly basis afterwards. In the first phase of the project, KDM will count on the supervision of the flare supplier for training, commissioning and start-up. In a second phase, i.e. if the power generation is chosen, KDM will also acquire either from equipment supplier and/or specialist consultant all the services needed for training related to the operation of the LFG generation system. KDM staffs to be trained are those with extensive experience at the landfill.</p>	<p>OK, CL 2 is closed.</p>

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p>CL 3</p> <p>It needs to be clarified if the EIA of Loma Los Colorados landfill was approved under the assumption that part of LFG was expected to be flared</p>	A.3.1	<p>Loma Los Colorados was the first landfill in Chile that voluntarily entered into the Environmental Impact Evaluation System (Sistema de Evaluación de Impacto Ambiental, SEIA) in 1995. As result of this evaluation by the authorities, the Environmental Impact Study (EIS) submitted by Kenbourne Ingeniería Ambiental S.A. (by then the owner of the landfill) stated their commitment of just collecting the landfill gas and venting it to the atmosphere but in no case flaring it. The real objective of this commitment was to prevent the migration of landfill gas to the ground water and polluting it with the soluble parts of LFG. Moreover, the Resolution of Environmental Qualification Resolution (RCA, in Spanish) issued by the environmental authorities and the only mandatory document only required LFG monitoring at key points of the landfill e.g. the perimeter and the vent wells what has been done regularly every three months. Such monitoring has been conducted regularly every three months. On a voluntary basis, KDM's installed a limited flaring system in 1998, and started its operation on a non-regular basis. (Source: <a href="http://www.e-seia.cl/documentos/documento.php?idDocumento=1506593">http://www.e-seia.cl/documentos/documento.php?idDocumento=1506593</a> in item 1.1.7.b).</p>	<p>Ok. CL 3 is closed.</p> <p>The license and environmental permits have been verified not to include an amount of LFG to be flared.</p>

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
		Additionally, the same document, page 5, second paragraph, <i>status</i> “Hasta el momento esta comprometida la extracción de biogás para controlar principalmente los aumentos de presión interna del Relleno Sanitario y riesgos de acumulaciones puntuales que podrían dar paso a una inflamación superficial no deseada, objetivos que se cumplen con las cantidades de biogás actualmente captadas.” Translation: “So far, the commitment to extract landfill gas mainly for increases in the internal pressure of the sanitary landfill and the risks of local build up (of LFG) which could lead to an undesirable surface fire. These objectives are met with the quantity of LFG currently captured”.	
<b>CL-4</b> It should be clarified why IPCC and not local data (net calorific value, factor emission) have been used for the calculation of the emissions of the plants used to calculate the operating margin.	B.2.5	Local values as reported by the Chilean Central Grid operator have been used in calculating operating margin and build margin.	OK, CL 4 has been closed.
<b>CL 5</b> The source of the data used for the calculation of the operating margin and build margin emission coefficient seems to be “anuario 2005” of SDEC-SIC and not “anuario 2004” as stated in page 51 of the PDD.	B.2.6	The source of data used is “Anuario 2006”. Corrected in PDD.	The PDD has been corrected to include this change. The CL 5 is closed.
<b>CL-6</b> The project proponent should be more specific referring to the starting date of the project.	C.1.1	The project is expected to be under operation (i.e. flaring LFG) on December 1 <sup>st</sup> , 2006.	Ok. CL 6 is closed.

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p><del>CL 7</del></p> <p>The monitoring plan includes amount of LFG sold off site (<math>LFG_{\text{sold}, y}</math>). This needs to be revised since the methodology currently does not allow for sale of methane captured.</p>	D.2.1	Excluded in PDD 18 December 2006	OK. CL 7 is closed
<p><del>CL 8</del></p> <p>The PDD does not specify if the grid emission factor will be calculate ex post or is fixed for the entire crediting period</p>	D.2.1	The EF is fixed for the entire crediting period. This has been specified in the new version of the PDD	OK. CL 8 is closed.

Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p>CL 9</p> <p>Some information provided related to the calibration of monitoring equipment should be clarified:</p> <p>Calibration vs. verification of flow meters. Idem gas analyser. Info provided in pages 27 and 28 seems inconsistent.</p> <p>Information about uncertainty, accuracy, range, calibration/verification periods, should be provided with regard to measurement equipments.</p>	D.5.5	<p><u>Flow Meter:</u></p> <ul style="list-style-type: none"> <li>• Range: 850 – 3150 SCFM</li> <li>• Accuracy: <math>\pm 1.5\%</math> of reading + 15.75 SCFM</li> <li>• It will be cleaned every 2 months and the accuracy will be verified at least once a year. This can be done using a Pitot tube with liquid filled manometer.</li> <li>• Calibration will be done if the annual verification of accuracy using the Pitot tube is found to be inaccurate. A hand-held calibrator will be used.</li> </ul> <p><u>Gas Analyzer:</u></p> <ul style="list-style-type: none"> <li>- CH<sub>4</sub> and CO<sub>2</sub>:             <ul style="list-style-type: none"> <li>• Range: 0 – 100%</li> <li>• Accuracy: <math>\pm 1.2\%</math></li> </ul> </li> <li>- O<sub>2</sub>:             <ul style="list-style-type: none"> <li>• Range: 0 – 25%</li> <li>• Accuracy: <math>\pm 0.1875\%</math></li> <li>• The accuracy of the gas analyzer will be verified at least once per year. Such verification will be done throughout the comparison of the analyzer measurement with the label of a patron/standard gas balloon.</li> <li>• The calibration will be done any time when the biogas flow verification performed as above demonstrates that the accuracy is without the established range of both the analyzer and the standard gas.</li> </ul> </li> </ul>	OK, CL 9 is closed.



Draft report corrective action requests and requests for clarifications	Ref. to Table 2	Summary of project participants' response	Final conclusion
<p>CL 10</p> <p>There is no evidence of how the project proponent justifies the reliability of the data of municipal waste expected to be delivered to the site.</p>	E.3.1	<p>The current contract between the municipalities and KDM will end up in 2011. However, it is automatically renewable for 16 years more if none of the parties states the contrary not later than August 2009. For the explanation below mentioned, it is highly improbable the non renewal. In fact, Loma Los Colorados landfill has the biggest area in the Metropolitan Region available for waste disposal, with a total capacity of 130 million tonnes of waste (until year 2045, at least). The landfill is also very well located, in a rural area, reducing potential problems with the community. Moreover, a railway link provides an excellent means for transporting waste from the city to the landfill site. For these reasons, waste is expected at the landfill site for far longer than the longest possible CDM crediting period. In any case, waste availability and contracts may be checked at the start of each renewal of the crediting period.</p>	OK. CL 10 is closed
<p>CL 11</p> <p>The selected values of Lo and K, even when conservative, are not formally justified in the PDD.</p>	E.3.4	<p>Note that emissions reductions are determined by measurements of landfill gas capture rates, following project implementation. Moreover, since there are very few operating landfill gas capture systems in non Annex 1 countries, estimates of Lo and k have not yet been calibrated in these countries. However, estimates of Lo and k, obtained from IPCC model parameters, have been used and these details have now been added to the PDD, Annex 3.</p>	CL 11 is closed.

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## **APPENDIX B**

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### **CERTIFICATES OF COMPETENCE**



# CERTIFICATE OF COMPETENCE

## *Einar Telnes*

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	Yes
<b>CDM Verifier:</b>	Yes	<b>JI Verifier:</b>	Yes
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 1,2,3,6 & 10		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM0001, AM0002, AM0003, AM0010, AM0011, AM0012, AMS-III.G	Yes	AM0021	Yes
ACM002, AMS-I.A-D, AM0019, AM0026, AM0029	Yes	AM0023	Yes
ACM003, ACM0005, AM0033, AM0040	Yes	AM0024	Yes
ACM0004	Yes	AM0027	Yes
ACM0006, AM0007, AM0015, AM0036, AM0042	Yes	AM0028, AM0034	Yes
ACM0007	Yes	AM0030	Yes
ACM0008	Yes	AM0031	Yes
ACM0009, AM0008, AMS-III.B	Yes	AM0032	Yes
AM0006, AM0016, AMS-III.D	Yes	AM0035	Yes
AM0009, AM0037	Yes	AM0038	Yes
AM0013, AM0022, AM0025, AM00379, AMS- III.H, AMS-III.I	Yes	AM0041	Yes
AM0014	Yes	AM0034	Yes
AM0017	Yes	AMS-II.A-F	Yes
AM0018	Yes	AMS-III.A	Yes
AM0020	Yes	AMS-III.E, AMS-III.F	Yes

Høvik, 6 November 2006

**Einar Telnes**  
*Director, International Climate Change Services*

**Michael Lehmann**  
*Technical Director*



## CERTIFICATE OF COMPETENCE

***Michael Lehmann***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	Yes
<b>CDM Verifier:</b>	Yes	<b>JI Verifier:</b>	Yes
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 1,2,3 & 9		
<b>Technical Reviewer for (group of) methodologies:</b>			
ACM0001, AM0002, AM0003, AM0010, AM0011, AM0012, AMS-III.G	Yes	AM0021	Yes
ACM002, AMS-I.A-D, AM0019, AM0026, AM0029	Yes	AM0023	Yes
ACM003, ACM0005, AM0033, AM0040	Yes	AM0024	Yes
ACM0004	Yes	AM0027	Yes
ACM0006, AM0007, AM0015, AM0036, AM0042	Yes	AM0028, AM0034	Yes
ACM0007	Yes	AM0030	Yes
ACM0008	Yes	AM0031	Yes
ACM0009, AM0008, AMS-III.B	Yes	AM0032	Yes
AM0006, AM0016, AMS-III.D	Yes	AM0035	Yes
AM0009, AM0037	Yes	AM0038	Yes
AM0013, AM0022, AM0025, AM00379, AMS-III.H, AMS-III.I	Yes	AM0041	Yes
AM0014	Yes	AM0034	Yes
AM0017	Yes	AMS-II.A-F	Yes
AM0018	Yes	AMS-III.A	Yes
AM0020	Yes	AMS-III.E, AMS-III.F	Yes

Høvik, 6 November 2006

**Einar Telnes**  
*Director, International Climate Change Services*

**Michael Lehmann**  
*Technical Director*



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## CERTIFICATE OF COMPETENCE

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### *Miguel Rescalvo*

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	--
<b>CDM Verifier:</b>	--	<b>JI Verifier:</b>	--
<b>Industry Sector Expert for Sectoral Scope(s):</b>	--		

Høvik, 6 November 2006

Einar Telnes  
Director, International Climate Change Services

Michael Lehmann  
Technical Director

### *Filipe Tavares*

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1)

<b>GHG Auditor:</b>	Yes		
<b>CDM Validator:</b>	Yes	<b>JI Validator:</b>	--
<b>CDM Verifier:</b>	Yes	<b>JI Verifier:</b>	--
<b>Industry Sector Expert for Sectoral Scope(s):</b>	Sectoral scope 9 & 13		

Høvik, 6 November 2006

Einar Telnes  
Director, International Climate Change Services

Michael Lehmann  
Technical Director



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## CERTIFICATE OF COMPETENCE

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***Mathsy Kutty***

Qualification in accordance with DNV's Qualification scheme for CDM/JI (ICP-9-8-i1-CDMJ1-i1

<b><i>GHG Auditor:</i></b>	--		
<b><i>CDM Validator:</i></b>	--	<b><i>JI Validator:</i></b>	--
<b><i>CDM Verifier:</i></b>	--	<b><i>JI Verifier:</i></b>	--
<b><i>Industry Sector Expert for Sectoral Scope(s):</i></b>	--		

Høvik, 6 November 2006

Einar Telnes  
*Director, International Climate Change Services*

Michael Lehmann  
*Technical Director*