



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004**

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**SECTION A. General description of project activity****A.1 Title of the project activity:**

Cosmito landfill gas project (Improvement of Gas Extraction System in Old Cosmito Dump)

A.2. Description of the project activity:

The Cosmito site is an unmanaged landfill (dump) that has operated since October 1990 until 3 September 2004. The site operated without interruptions and received waste from the communities of Concepción, Penco, San Pedro de La Paz, Chiguayante, Hualqui, and Talcahuano. The site was closed down in 2004 because the permit was no longer valid.

There is currently no system for the active capture and flaring of landfill gas and no system was required by the permit. The purpose of the Cosmito landfill gas project is to install a highly efficient landfill gas collection system. This will involve investing in a gas collection system, airtight covering of the landfill, and flaring equipment.

Copiulemu S.A. has a contract with the owner of the land where the landfill is located wherein it is agreed that Copiulemu S.A. has all the rights to the landfill gas.

The main social and environmental impacts of this project will be a positive effect on health and amenity in the local area. The release of landfill gas can have a negative impact on the health of the local environment and the local population and lead to risks of explosions in the local surroundings. The project will also have a small, but positive impact on employment in the local area as a number of staff will need to be recruited to manage the landfill gas operations.

The project is helping the Host Country fulfil its goals of promoting sustainable development. Specifically, the project:

- Increases employment opportunities in the area where the project is located;
- Uses clean and efficient technologies;
- Acts as a clean technology demonstration project;
- Optimises the use of natural resources, avoid uncontrolled waste management.

A.3. Project participants:

Copiulemu S.A., a Chilean company specializing in the treatment of industrial and household waste substances in the 8th Region. Copiulemu is a subsidiary of the Belgian Group Machiels.

Further contact information of the project participant is provided in Annex 1.

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:**

**A.4.1.1. Host Party(ies):**

Chile

A.4.1.2. Region/State/Province etc.:

Región VIII: Región del BíoBío.

A.4.1.3. City/Town/Community etc:

Talcahuano

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The Cosmito landfill site is located at “Fundo San José de Cosmito”, at approximately 6 km from the cities of Concepción and Penco.

The Fundo San José de Cosmito has a surface of 60 ha, of which 12 ha received a permit to be used as a landfill.

A.4.2. Category(ies) of project activity:

Sectoral Category 13 - Waste handling and disposal

A.4.3. Technology to be employed by the project activity:**Landfill gas collection system:**

State-of-the-art gas collection technology will be used. This includes:

- vertical wells used to extract gas;
- optimal well spacing for maximum gas collection;
- gas headers designed as a looping system in order to allow for partial or total loss of header function in one direction without losing gas system functionality, and
- condensate extraction and storage systems designed at strategic low points throughout the gas system.

All efforts will be made to minimize problems in condensate management.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the

**emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:**

The proposed project involves the collection and combustion of landfill gas that is currently released into the atmosphere, thus converting its methane content into CO₂ and reducing its greenhouse gas effect.

There is currently no system in place for the capture and flaring of landfill gas and this was not required in the permit while Cosmito was operational.

The baseline scenario is defined as the most likely future scenario in the absence of the proposed CDM project activity. Establishing this future scenario requires an analysis and comparison of possible future scenarios using a comparison methodology that is justified for the project circumstances. Based on this analysis (see section B below), the baseline scenario is the continued release of the majority of the landfill gas to the atmosphere, similar to the current practice of most landfills in Chile.

A technical analysis was conducted in order to quantify the potential volume of emissions reductions that the project can generate. The analysis was conducted based on the projections of carbon emissions for the project and its baseline. It was found that the project has the capacity to generate 1.033.056 tonnes of CO₂e reductions over its 21-year lifetime.

The results of the financial analysis conducted clearly show that implementation of this type of project is not the economically most attractive course of action. Given this, the project is not part of the baseline scenario and it can be concluded that the project is additional (see B.3).

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

This project is expected to avoid 593,071 tCO₂e emissions over the first seven year crediting period, and 1.033.056 tCO₂e over 21 years.

Refer to section E for further details on the quantification of GHG emission reductions associated with the project.

A.4.5. Public funding of the project activity:

The project will not receive any public funding from Parties included in Annex I of the UNFCCC, it is financed only with private capital.

SECTION B. Application of a baseline methodology**B.1. Title and reference of the approved baseline methodology applied to the project activity:**

According to the UNFCCC's Drafting Group on Technical Issues text on CDM (Decision-/CP.7 Article 12, Paragraph 48) a project must select a baseline approach relevant to the activity.



The baseline approach adopted for the Cosmito project is option 48(b) of the Marrakech text: The baseline is the scenario that represents “emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment”.

ACM0001, the “Consolidated baseline methodology for landfill gas project activities”, has been applied to this project.

A justification of the method’s appropriateness given the project circumstances are given below.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

The *consolidated baseline methodology for landfill gas project activities* is applicable where the baseline is either partial or total atmospheric release of the gas and the project activity either flares or utilizes the captured gas.

The Cosmito project involves the situation listed under a) in the baseline methodology, as the captured gas will only be flared in the project, and not used to produce electricity. The project baseline is the partial atmospheric release of the gas. The Cosmito project thus meets the applicability requirements as described in the *consolidated baseline methodology for landfill gas project activities*.

The selected approach from paragraph 48 of the CDM modalities and procedures in this methodology is: “Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment.” This approach is appropriate for this project, as the project involves a significant investment that would not have any financial return without CER revenue.

B.2. Description of how the methodology is applied in the context of the project activity:

The consolidated methodology for landfill gas project activities provides instructions and a formula for calculating the emission reductions of a landfill project. Since the Cosmito project only involves flaring, this formula can be simplified as follows:

$$ER_y = (MD_{project_y} - MD_{reg_y}) * GWP_{CH_4}$$

Where ER_y is the greenhouse gas emission reduction achieved by the project activity during a given year “y”, calculated as the difference between the amount of methane actually destroyed/combusted during the year ($MD_{project_y}$) and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity (MD_{reg_y}) times the approved Global Warming Potential value for methane (GWP_{CH_4}).

ER_y is measured in tonnes of CO₂ equivalents (tCO_{2e}). $MD_{project_y}$ and MD_{reg_y} are measured in tonnes of methane (tCH₄). The approved Global Warming Potential value for methane (GWP_{CH_4}) for the first commitment period is 21 tCO_{2e}/tCH₄.



Since regulatory requirements have not specified the quantity of MDreg, an “Adjustment Factor” (AF) for determining the baseline is used.

Where the Cosmito landfill is covered, it has a very simple venting system consisting of oil drums with holes in them to vent the biogas. The biogas also reaches the atmosphere via the cover layer. As a small part of the vents may be burning in the baseline (as was the case in 2004), an Adjustment Factor of 10% is taken. This is considered to be conservative, as only a very small part of the gas was actually burned during site visits in 2004. Also, since the landfill is now no longer operational, it is very unlikely that anyone would light the vents after flames go out because of rain or wind.

Currently the Chilean Ministry of Health is developing legislation at the national level that would also involve an obligation to capture and flare part of the landfill gas. The purpose of this obligation is to prevent the risks of explosions. This legislation is still at a draft stage and it has not been decided yet what percentage has to be flared. In the various discussions that were held with stakeholders, percentages for the capture and flare obligation varying from 10 – 20 percent were mentioned.

However, under Chilean law, such new legislation could not apply to landfills that are already operating under an existing permit, nor would it apply to landfills that are not operational anymore.¹ This potential future legislation thus has no effect on the Cosmito baseline.

Having established the Adjustment Factor, the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity (MDreg_y) is calculated as follows:

$$\text{MDreg}_y = \text{MDproject}_y * \text{AF (where AF=10\%)}$$

As specified by the consolidated methodology, the ex ante emission reduction estimates are made by projecting the future GHG emissions of the landfill. The US EPA First Order Decay Model is used to perform these calculations.

The actual emission reductions will be determined (*ex post*) by metering the actual quantity of methane captured and destroyed once the project activity is operational.

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

The determination of additionality is done using the CDM consolidated tool for demonstration of additionality, which follows the following steps:

Step 0. Preliminary screening of projects started after 1 January 2000 and prior to 31 December 2005

¹ Source: Jaime Dinamarca Garate, lawyer at the Chilean Federation of Industry (SOFOFA), phone : 0056 2 391 3180, email: jdinamarca@sofofa.cl.



The project is only expected to start operation after its registration as a CDM project with the UNFCCC. In any case, as it will be demonstrated in the following steps, CDM revenue has been considered from the early stages of development of the project, and it is an integral part of the financial package of the project.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Alternative 1: The Business as Usual scenario. The continuation of the current situation without flaring, as no new requirements would be introduced for a landfill that is no longer operational, there would be no changes over time in this scenario.

Alternative 2: The landfill operator would invest in LFG collection equipment, power generation equipment and a grid connection, to supply power to the Chilean grid.

Alternative 3: The landfill operator would invest in a landfill gas collection system, as well as a high efficiency flaring system (the proposed project activity).

Other scenario's for a landfill might be the utilization of the landfill gas to supply heat, steam, or the upgrade of the landfill gas to natural gas quality. For Cosmito, none of these scenario's are plausible, as the landfill is too small to make such utilization economically feasible. There is no industry to which heat or gas could be supplied in the vicinity of the landfill. A connection to the natural gas grid and equipment to upgrade the biogas to natural gas quality are too expensive.

Sub-step 1b. Compliance with applicable laws and regulations:

All the alternatives comply with the laws and regulatory requirements in the project location. As explained under B.2., new landfill legislation in Chile would not apply to Cosmito, as it is no longer operational.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method

According to the methodology for determination of additionality, option I should be used if the CDM project activity generates no financial or economic benefits other than CDM related income. As this is the case for Cosmito, the simple cost analysis will be used. To show that electricity production is not a viable baseline alternative, the benchmark analysis of option III will be used as well.

Sub-step 2b: Option I + III – simple cost analysis and application of benchmark analysis

*Simple cost analysis*

Alternative 3 (the project activity) will involve extra investments in an efficient gas collection system, airtight covering of the landfill, and flaring equipment.

The extra investments are estimated at approximately €1,500,000.

By investing in a gas capturing system, Cosmito will not generate any revenues in the absence of CDM. Alternative 3 is therefore not an economically attractive scenario and not a realistic baseline scenario.

Benchmark analysis

The likelihood of Alternative 2, as opposed to the Business as Usual scenario will be determined by comparing its IRR with the benchmark of the interest rate available to a local investor, i.e., as provided by local banks in Chile. A very conservative interest rate of 4% has been used in the analysis, which is the cost of capital for a bank loan to Group Machiels in Belgium.

Sub-step 2c: Comparison of financial indicators

The Table below shows the financial analysis for Alternative 2. As shown, the project IRR (without carbon) is -7%. As the project IRR is negative, the Net Present Value will be negative at any interest rate and Alternative 2 is thus not a viable baseline alternative.

Table: Financial results of Alternative 2 without carbon finance. NPV uses 4% discount rate.

	with carbon	without C
Net Present Value (US\$)	1,337,430	535,230-
IRR	23%	-7%
Discount rate	4%	4%

Summary of results of project analysis.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Increase in project revenue (price of electricity sold to the grid);
- Reduction in project capital (CAPEX) and running costs (Operational and Maintenance costs).

Those parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 10 %, and assessing what the impact on the project IRR would be (see Table below). As can be seen, the project IRR remains negative even in the case where these parameters change in favour of the project.

Net Present Value (US\$)	IRR (%)
Original	-7.19%
Increase in project revenue	-2.35%



Reduction in project costs

-2.68%

Note: NPV uses 4% discount rate.

Step 4. Common Practice Analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

To date there has been limited development of landfill gas projects in the Host Country. Although permits for new landfills in Chile often mention gas capture and flaring, the current practice in Chile is either no flaring at all or the unmanaged flaring of some of the gas.

The current Chilean national legislation does not require that landfills collect and dispose of landfill gases. So far, only a few landfills in Chile have been designed to collect and partially flare the gas generated. In the few cases where gases are collected, this is done for safety reasons (to avoid explosions), and it is often the case that the amounts effectively collected are very low. Investments done with this purpose is low and the technology used is very poor, with few exceptions.

Currently, only one landfill in Santiago is implementing a flaring system and a second one is installing a collecting system, but all over the country this is the case for less than three percent of the landfills.

There are some preliminary plans to install efficient capture and flaring systems for other landfills, but these are all in the context of CDM. No examples exist in Chile of landfills that have been closed down that have an active gas capturing system.

Sub-step 4b. Discuss any similar options that are occurring:

Where other similar projects are planned, these are all to be developed under the CDM. This does not call into question the claim that the Cosmito project is financially unattractive without the CDM.

Step 5. Impact of CDM registration

As shown in Step 2 above, the project is unlikely to move forward without the additional financial support of the CDM. As the project will generate 1.033.056 tonnes of CO₂e credits over its 21-year lifetime, the revenue generated by carbon sales would be sufficient to make the project go ahead. Approval and registration as a CDM activity will thus alleviate the economic and financial hurdles.

According to the above analysis, the Cosmito project is not the baseline scenario.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

For the baseline determination, the project boundary is the physical site of the project activity where the gas will be captured and destroyed.

Table B.4 –project and system boundaries

Emissions	Project Scenario	Baseline Scenario
Direct on-site	Emissions associated with fugitive	Uncontrolled release of landfill gas



	landfill gas emissions. It has been estimated that approximately 60% of the landfill gas generated will be captured.	generated.
Direct off-site	Transportation of equipment to project site – excluded	Transportation of equipment to project site – excluded
Indirect on-site	Emissions from construction of the project (gas collection and flaring system). These emissions are excluded as they are not under control of the project developer and are insignificant (less than 1%) compared to the total emissions. constructed.	Emissions from construction of a less effective capturing system.
Indirect off-site	Transport of waste to the landfill site(s) – excluded	Transport of waste to the landfill site(s) - excluded

**B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:**

The baseline study was concluded in November 2004.

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SECTION C. Duration of the project activity / Crediting period**C.1 Duration of the project activity:****C.1.1. Starting date of the project activity:**

Estimated at 15/1/2006 (starting date of the project activity is defined as the start of the actual gas capture)

C.1.2. Expected operational lifetime of the project activity:

21 years

C.2 Choice of the crediting period and related information:**C.2.1. Renewable crediting period****C.2.1.1. Starting date of the first crediting period:**

Estimated at 15/01/2006

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:****C.2.2.2. Length:****SECTION D. Application of a monitoring methodology and plan****D.1. Name and reference of approved monitoring methodology applied to the project activity:**

ACM0001 "Consolidated monitoring methodology for landfill project activities"

**D.2. Justification of the choice of the methodology and why it is applicable to the project activity:**

The chosen methodology is to be used in conjunction with baseline methodology ACM0001. The Cosmito project involves the situation listed under a) in the monitoring methodology, as the captured gas will be flared in the project. The project baseline is the partial atmospheric release of the gas. The Cosmito project thus meets the applicability requirements as described in the *consolidated monitoring methodology for landfill gas project activities*.

**D.2.1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario**

Option 2 is chosen here, see 2.2

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number (Please use numbers to ease cross-referencing to D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

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D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment



D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

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D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
1. LFG For MD project _y	Total amount of landfill gas captured	m ³	M	Continuously/periodically	100%	electronic	During the crediting period and two years after	Measured by a flow meter. Data to be aggregated monthly and yearly.
2. LFG for MD flared _y	Amount of landfill gas flared	m ³	M	Continuously/periodically	100%	electronic	During the crediting period and two years after	Measured by a flow meter. Data to be aggregated monthly and yearly.
3. FE	Flare/combustion efficiency, determined by the operation hours (1) and the methane content in the exhaust gas (2)	%	m/c	(1) continuously (2) quarterly, monthly if unstable	n/a	electronic	During the crediting period and two years after	(1) Periodic measurement of methane content of flare exhaust gas. (2) Continuous measurement of operation time of flare (e.g. with temperature)
4. F _{CH₄,y}	Methane fraction in the landfill gas	m ³ CH ₄ / m ³ LFG	M	Continuously/periodically	100%	electronic	During the crediting period and two years after	Measured by continuous gas quality analyser.



5. T	Temperature of the landfill gas	°C	m	Continuously/periodically	100%	electronic	During the crediting period and two years after	Measured to determine the density of methane D_{CH_4}
6. p	Pressure of the landfill gas	Pa	m	Continuously/periodically	100%	electronic	During the crediting period and two years after	Measured to determine the density of methane D_{CH_4}
7.	Regulatory requirements relating to landfill gas projects (used to recalculate AF)	Text	n/a	Annually	100%	electronic	During the crediting period and two years after	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y}$
8	Total amount of electricity and/or other energy carriers used in the project for gas pumping and heat transport (not derived from the gas)	MWh	m	Continually	100%	Electronic	During the crediting period and two years after	Required to determine CO ₂ emissions from use of electricity or other energy carriers to operate the project activity



9	CO2 emission intensity of the electricity and/or other energy carriers in ID 8.	CO2e/MWh	c	Annually	100%	electronic	During the crediting period and two years after	<p>Required for any changes to the adjustment factor (AF) or directly MDreg,y. In the monitoring section of the PDD the emission reductions which result from the electricity usage of the landfill gas extraction unit are now included.</p> <p>For the CO2 emission intensity of the grid a value of 0.987 t CO2e/MWh will be used. This is the value for a coal conventional steam power plant according to the EM model², The CEFs provided through the EM model are similar to those made available by the US Energy Information Agency (EIA). This is considered to be an conservative estimate given the fact in the validated PDD of the Santa Rosa hydro power project includes a CEF value of the Chilean grid of 0.476 t CO2e/MWh.</p>
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D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

² Öko institute, 1998

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**D.2.3. Treatment of leakage in the monitoring plan****D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity**

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment

Not applicable.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

No leakage effects have been identified. The applicable monitoring methodology does not require leakage to be accounted for.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

$$ER_y = (MD_{project,y} - MD_{reg,y}) * GDP_{CH4}$$

Where:

ER_y : greenhouse gas emission reduction achieved by the project activity during a given year “y” (t CO₂e).

$MD_{project,y}$: amount of methane actually destroyed/combusted during the year “y” (tCH₄).

$MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year “y” in the absence of the project activity (tCH₄).

GDP_{CH4} : approved Global Warming Potential value for methane (21 t CO₂e / tCH₄).

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As the project will not include a thermal energy or electricity component, these factors will be excluded from the overall equation.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data (Indicate table and ID number e.g. 3.-1.; 3.2.)	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1. LFG For MD project _v	Low	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy
2. LFG for MD flared _v	Low	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy
3 FE	Medium	Regular maintenance will ensure optimal operation of flares. Flare efficiency should be checked quarterly, with monthly checks if the efficiency shows significant deviations from previous values.
4 F _{CH_{4,v}}	Low	The gas analyser should be subject to a regular maintenance and testing regime to ensure accuracy.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

The project monitoring will be conducted by Alfredo Gustavo Kother Feest, Mechanical Engineer of the Concepción University, Executive and Legal Representative of Group Machiels in Chile, Director of Copiulemu S. A..

To develop the project, Mr. Kother will count with the collaboration of the technical team of group Machiels in Chile, with more than 20 specialists in different areas of environmental activity.

D.5 Name of person/entity determining the monitoring methodology:

Alfredo Gustavo Kother Feest

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**SECTION E. Estimation of GHG emissions by sources****E.1. Estimate of GHG emissions by sources:**

The source of emissions from the project is the combustion of landfill gas, converting methane into CO₂. As the methane is organic in nature these emissions are not counted as project emissions.

The emissions of the electricity consumption should be accounted as project emissions. By monitoring the electricity consumption of the gas extraction system and the CEF of Chile the emission can be determined. For now and estimate will be determined.

It is assumed that the electrical capacity of the gas extraction unit is 20 kW and that the load factor is 50%. A CER of 1 kg/kWh is used. With these assumptions it can be calculated that the annual emission from the electricity consumption is 88 CERs.

E.2. Estimated leakage:

No leakage has been identified and needs to be accounted for by this methodology.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Not applicable.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

The consolidated methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the baseline scenario, as opposed to the amount of methane emitted in this scenario. We will use the convention established in the consolidated methodology and use this section to describe the amount of methane destroyed in the baseline scenario. The equation is, as follows:

$$MD_{reg,y} = MD_{project,y} * AF$$

Where:

- $MD_{reg,y}$: amount of methane that would have been destroyed/combusted during the year “y” in the absence of the project activity (tCH₄).
- $MD_{project,y}$: amount of methane actually destroyed/combusted during the year “y” (tCH₄).
- AF = Adjustment Factor (%)

The methane destroyed by the project was estimated using the USEPA First Order Decay Model³, using Lo and k values appropriate for the VIII region in Chile⁴ and assuming that 60% of the landfill gas

³ On this model, see US EPA manual “Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators” (December 1994).

⁴ Values chosen for Lo and k are confirmed in a report by the Inter American Development Bank. The value for k of 0.1 provided specifically for the VIII region in Chile (Región del BíoBío, where Copiulemu is located), and the value for Lo of 2.63 is given for Chile as a whole (this is the standard value from the US EPA model, that is



generated is collected by the gas collection system. In any case, as this projection is merely for illustrational purposes (i.e., the actual emissions reductions will be monitored directly).

The AF value used for this project is 10% (see section B.2 for the justification of this value). The value for AF will be revisited at the beginning of each crediting period and will be adjusted if it is affected by any changes in requirements or circumstances.

The Table below shows the destruction of methane that would have taken place in the baseline scenario (MD_{reg}), using the equations described above and the US EPA model.

	Per year (average)	7 years	21 years
$MD_{project}$ (tCH ₄)	4,487	31,412	54,757
AF (%)	10%	10%	10%
MD_{reg} (tCH ₄)	449	3,141	5,476

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

The consolidated methodology for landfill projects uses an equation for calculating the amount of methane destroyed in the project scenario, as opposed to the amount of methane emitted in this scenario. We will use the convention established in the consolidated methodology and use this section to describe the amount of methane destroyed in the project scenario. The equation is, as follows:

$$MD_{project,y} = MD_{flared,y}$$

Where:

$MD_{project,y}$: amount of methane actually destroyed/combusted during the year “y” (tCH₄).

$MD_{flared,y}$: quantity of landfill gas flared during the year “y” (tCH₄).

The Table below shows the emissions reductions taking place in the project scenario ($MD_{project}$), using the equations described above and the US EPA model.

	Per year (average)	7 years	21 years
LFG _{flare} (m ³ LFG)	12,776,254	89,433,777	155,899,375
W _{CH4} (%)	50%	50%	50%
D _{CH4} (t CH ₄ /m ³ CH ₄)	0.0007168	0.0007168	0.0007168
FE (%)	98%	98%	98%

confirmed for Chile in this report). Banco Interamericano de Desarrollo, Informe de Avance, *Estudio de Políticas de Abatimiento de Gas de Efecto Invernadero y Desarrollo Económico: Sinergias y Desafíos para el caso de Chile*, Preparado por: Bitrán & Asociados Santiago, Mayo 2003.



$MD_{project} = MD_{flared}$ (tCH ₄)	4,487	31,412	54,757
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E.6. Table providing values obtained when applying formulae above:

The estimated results are presented in the following Table. The actual emission reductions generated by the project will be measured directly after the project is operational.

	Per year (average)	7 years	21 years
$MD_{project}$ (tCH ₄)	4,487	31,412	54,757
MD_{reg} (tCH ₄)	449	3,141	5,476
GWP_{CH_4}	21	21	21
Electricity consumption emission	88	616	1,848
Electricity emissions reductions (tCO ₂)	0	0	0
Emissions reduction generated by the project activity (ER, tCO ₂ e/year)	84,724	593,071	1,033,056

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

By collecting and combusting landfill gas, the Cosmito project will reduce both global and local environmental effects of uncontrolled releases. The major components of landfill gas, methane and carbon dioxide, are colorless and odorless. The main global environmental concern over these compounds is the fact that they are greenhouse gases. Although the majority of landfill gas emissions are quickly diluted in the atmosphere, in confined spaces there is a risk of asphyxiation and/or toxic effects if landfill gas is present at high concentrations. Landfill gas also contains over 150 trace components that can cause other local and global environmental effects such as odor nuisances, stratospheric ozone layer depletion, and ground-level ozone creation. Through appropriate management of the site, landfill gas will be captured and combusted, removing the risks of toxic effects on the local community and local environment.

Combustion of landfill gas can also result in the release of organic compounds and trace amounts of toxic materials, including mercury and dioxins. These emissions are significantly less harmful than the continued uncontrolled release of landfill gas.

The project will have very limited effects regarding noise and visual amenity.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:



Not applicable. The Cosmito project meets and goes beyond all permit requirements.

Discussions with the government on the necessity of an environmental impact assessment are ongoing.

SECTION G. Stakeholders' comments

G.1. Brief description how comments by local stakeholders have been invited and compiled:

Letters were sent to the relevant authorities related with environmental activity. The letters also related to the Copiulemu CDM project, which is developed parallel to the Cosmito project. Political (executive and legislative) authorities, sanitary authorities and environmental authorities were informed about the project and asked to give their opinion.

A similar letter was also sent to the 'Federación Provincial de Uniones Comunales de Juntas de Vecinos de la Provincia de Concepción', that represents 11 communities in de province of Concepción.

An independent company (Cidem LTDA) was hired in order to develop an opinion poll in the nearest neighbourhoods to the Cosmito landfill.

Copiulemu S.A. also put announcements in an important local newspaper in order to inform the public and to invite people to make comments and observations.

G.2. Summary of the comments received:

The reaction of the authorities is to support the development of the project, under Chilean and International legislation. Environmental Authorities recognise that this project is improving the original operational conditions, as authorised by the resolution of March 2000. Supporting letters where received from the 'federation of local communities', from a member of Chilean parliament, and from the commission of environment in the Bio Bio region (CONAMA).

The people in the neighbourhood of Cosmito received the information positively.

No negative comments were received.

G.3. Report on how due account was taken of any comments received:

No negative comments were received, nor any other comments that should lead to any changes in the project.

Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Empresa de Tratamiento de Residuos Copiulemu S.A.
Street/P.O.Box:	Calle B N° 1170
Building:	Lomas de San Sebastián
City:	Concepción
State/Region:	Region del Bio Bio (VIII Region)
Postfix/ZIP:	
Country:	Chile
Telephone:	0056 41 485011
FAX:	0056 41 485007
E-Mail:	
URL:	
Represented by:	Alfredo Kother Feest
Title:	General Manager Copiulemu
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	0056 41 485007
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Personal E-Mail:	a.kother@ilsansebastian.cl

Annex 2**INFORMATION REGARDING PUBLIC FUNDING**

This project will not receive any public funding.

Annex 3**BASELINE INFORMATION****Inputs for baseline and emission reductions calculation.**

INPUTS	
Year analysis was conducted	2004
LANDFILL DATA	
	List of countries
Country	Chile
Year started landfill operation	1990
Year finished operation	2004
Waste in place at beginning of project (tonnes)	1,863,000
R = Average daily waste rate (t/day)	345
Maximum flow of gas collected (m ³ /h)	1,930
Lo (cf/lb) =	2.63
k (1/year)=	0.1
Methane content of landfill gas=	50%
BASELINE DATA	
Residual emission factor CH ₄ to CO ₂	0
Proportion of methane flared in baseline (AF, %)	10%
PROJECT DATA	
Date gas collection project starts (year)	2005
Proportion of methane collected (%)	60%
Combustion effectiveness of Flare (%)	98%

Annex 4**MONITORING PLAN**
