Ardeer Engineering (Pty) Ltd

Monitoring Report

EnviroServ Chloorkop
Landfill Gas Recovery Project

CDM Ref. no. 0925

Monitoring Period: 19 January 2008 to 31 December 2008

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Contents

1 Project Background

This monitoring report has been prepared for the "EnviroServ Chloorkop Landfill Gas Recovery Project", (the project), UNFCCC reference number 0925. The Project is located at Chloorkop, Ekurhuleni Metropolitan Municipality, South Africa. The landfill at Chloorkop is owned by EnviroServ (Pty) Ltd (EnviroServ). The Project was validated on 1 February 2007 and was registered with UNFCCC on 27 April 2007 as a CDM project activity under Article 12 of the Kyoto Protocol. Monitoring information was included in the Project Design Document (the PDD) (revision 5, dated 5 February 2007).

Project participants are EnviroServ (Pty) Ltd (South Africa) and Japan Carbon Finance Ltd (Japan). Contractors and consultants involved in the project are ENER-G Systems (Pty) Ltd (South Africa), Biogas Technologies (Ltd) (United Kingdom) and Ardeer Engineering (Pty) Ltd (South Africa).

For further background on the project refer to the UNFCCC website:

http://cdm.unfccc.int/Projects/DB/DNV-CUK1171370021.04

The first renewable crediting period for the project, as given in the PDD, is from 1 July 2007 to 30 June 2014 (i.e. for 7 years). A request was submitted to the Executive Board that the start of the crediting period be changed to 19 January 2008, which was the date on which operation of the project started. A reply to this request has not been received to date.

This report is for the first monitoring period from 19 January 2008 to 31 December 2008.

This report was prepared for EnviroServ by Ardeer Engineering, a firm of engineering consultants, and is version 'A' issued on 6 January 2009.

2 Monitoring Background

The methodology utilised for the project is AM0011 version 02 – landfill gas recovery with electricity generation or no capture or destruction of methane in the baseline scenario.

AM0011 is applicable to projects where:

- The baseline is atmospheric release of the landfill gas;
- There are no regulations governing the landfill gas emissions;
- The captured gas is used to evaporate leachate, generate electricity for on-site use and/or is flared;
- Emissions reductions associated with generation of the displaced electricity do not generate credits.

As this is the first monitoring period for the project there are no forward action requests from previous verifications.

3 Monitoring Results

3.1 Emission reductions

The calculated emission reductions for the period amounted to **83 139** tCO2equiv.

The month-by-month calculated emission reductions are as follows:

Month (2008)	Average LFG flared (Nm3/h)	Average CH_4 concentration (%v/v)	Emission Reductions (t CO2equiv.)
January	962.5	53.0	1391
February	1 285.5	52.6	4828
March	1 610.5	57.7	7792
April	1 589.8	60.8	8174
May	1 657.5	58.1	8801
June	1 732.3	52.6	7196
July	1 575.3	50.1	7420
August	1 629.6	50.0	8007
September	1 580.9	48.9	7365
October	1 538.5	46.6	7160
November	1 519.5	51.1	7573
December	1 505.9	49.6	7432
AVERAGE	**1 515.7**	**52.6**	
TOTAL			**83 139**

3.2 Monitoring period covered

The monitoring period is from 19 January 2008 to 31 December 2008.

3.3 Presentation of monitoring results

The monitoring data, calculations and results are contained in an Excel workbook – See Annexure 1.

The workbook contains the following pages:

3.3.1 General information

This page gives the following general project information:

- CDM Identification (project name, description, CDM registration number, methodology etc.)
- CDM Activity Data (methane density and global warming potential, ex-ante flare efficiency etc.)
- Flare Information (flare ID, capacity etc.)
- Flow meter Correction Factors (correcting for methane concentration)
- Project Contacts (Biogas Technology)
- Emission Reduction Calculation Formulae

3.3.2 Monthly emission reduction worksheets

The monthly emission reduction calculation worksheets include all the relevant data to reproduce the emission reduction calculations from the raw data to emission reductions for every month of the monitoring period (one calculation sheet per calendar month).

3.3.3 Summary of the monthly emission reduction worksheet

This page contains the emission reduction summary table and graphs of the flowrate of landfill gas flared and calculated emission reductions.

4 Monitoring Data

4.1 Description of the main parameters

During this monitoring period all the gas collected from the landfill was flared. No gas was used for leachate evaporation, electricity generation or in other applications.

This means that:

- Landfill gas used for leachate evaporation ($LFG_{leachate,y}$) = 0
- Landfill gas used for electricity generation ($LFG_{electricity,y}$) = 0
- Landfill gas used for other application ($LFG_{app\ i,y}$) = 0
- Total amount of landfill gas collected (Q) = Landfill gas flared ($LFG_{flared,y}$)
- Electricity generated (EL) = 0

4.1.1 Landfill gas flared ($LFG_{flared,y}$)

The PDD for the project specified that the flowrate of the landfill gas would be measured by means of volumetric flowmeters (i.e. measuring m3/h). Temperature and pressure of the gas would also be measured so that the volumetric flow could be converted to a flow measurement at normal temperature and pressure (Nm3/h) (equivalent to a mass flow measurement).

The flowmeters that were installed were those operating on the thermal mass principle. Such flowmeters measure mass flow directly and the measurements do not require temperature and pressure measurement to give a normalised m3/h (mass) flow measurement. These flowmeters record the flow directly in Nm3/h.

This principle was agreed to by the Executive Board at their 36th meeting – see Consolidated baseline and monitoring methodology for landfill gas project activities (ACM0001 version 08 page 19).

No pressure measurement was installed when the flare system was commissioned. Pressure measurement equipment was subsequently installed in June 2008.

The thermal mass flowmeters measure the temperature of the gas as part of their measurement of the flow. No separate temperature measuring instruments are therefore installed.

The flow measured by thermal mass flowmeters is affected, to a small extent, by the composition of the gas. A correction factor is therefore required, based on the methane concentration of the gas. This correction is incorporated in the worksheet calculations.

4.1.2 Methane content ($w_{CH4,y}$)

The methane concentration of the landfill gas is measured by means of a continuous analyser.

4.1.3 Temperature of combustion (T_{comb})

The combustion temperature is measured by a thermocouple in the exhaust stack of the flare. A second thermocouple higher up in the flare exhaust stack is used as a check on the combustion temperature.

4.1.4 Flare efficiency (FE)

A flare efficiency test was carried out in June 2008. This was done by a local (South African) laboratory that, although using internationally accepted methods, was not accredited in terms of ISO 17025 to do the test. Although results of the test showed a methane destruction efficiency of 97%, the default value of 90% was used for the calculation of the emission reductions, because of the lack of the required accreditation for the laboratory test.

4.1.5 Flare hours

The flare working hours are calculated by the workbook for the periods when the flare is operating within the manufacturer's limits.

4.1.6 Electricity consumption (EL_{IMP})

Neither the methodology nor the PDD requires that the electricity consumed by the project be used in calculating the emission reductions. A preliminary verification carried out in July 2008 indicated that this leakage should be taken into account in the calculation. Clarification on this issue has been requested from the Executive Board.

The PDD does, however, require that the electricity consumed by the project be monitored to check the significance of the emissions.

The electricity consumed by the project was initially not measured directly. A kilowatt-hour meter was taken into service in May 2008. The electricity consumed up to the time the meter was installed was estimated from the electrical loads (in kW) and the running time of the flare. Subsequent to that, the electricity usage was recorded from the kilowatt-hour meter readings on a monthly basis.

The flare system is provided with an emergency generator to allow the flare to continue running in the event of a power failure. A record is kept of the running time of the generator.

5 Data gathering, processing and archiving

5.1 Data gathering

To ensure the integrity of all the monitoring information generated by the project, two independent streams of data are received for the flare; telemetry data (primary) and check sheet data (secondary).

Primary data is defined as the data representing the main variables for the calculation of the emission reductions. This data is sent from the site through telemetry to Biogas Technology Ltd (Biogas). Biogas has been subcontracted by ENER-G Systems (Pty) Ltd (Ener-G), the

company that manages the wellfield and the flare for EnviroServ. The information is received via a website, and is downloaded weekly.

Secondary data is defined as variables measured visually on site and includes the primary data variables. These variables are recorded once a day during day-shift. This data is sent to Biogas by uploading the daily check sheet data via a secure website.

The primary and secondary data are compared and checked for errors and consistency. Complete data is then saved in comma separated value (CSV) format and pasted into the Excel spreadsheet workbook. This workbook calculates the number of emission reductions, transfers the results to an operations report and produces a graph and a data table. This information is then used to create monthly and annual reports on the emission reductions.

In cases where the primary data is unavailable, the secondary data is relied on.

5.2 Data processing / calculations

The calculation of the emission reductions that is carried out in the workbooks is summarised in the steps below:

1. The following data is recorded every 30 minutes:
   - The flow of landfill gas.
   - The combustion temperature in the flare.
   - The exhaust temperature of the flare.
   - The temperature of the landfill gas going to the flare.
   - The concentration of the methane in the landfill gas going to the flare.
   - Whether the source of the data is primary, secondary or a combination of the two.
2. The following operational check is then done:
   - The concentration of methane in the gas is greater than 25% v/v;
   - The combustion temperature in the flare is greater than 700 ℃;
   - The flow of gas to the flare is greater than 200 Nm3/h

   If all parameters are Ok then this field is given a value of 1, if not Ok then a value of 0.
3. The frequency or time interval of the raw data is determined by subtracting the date and time for the previous reading from that of the current reading. This is then multiplied by the operational check value determined in step 2.
4. The quantity of gas (in Nm3) is then calculated by multiplying the flowrate as measured in step 1 by the time interval as determined in step 3.
5. A correction factor is calculated for the gas quantity using the measured methane concentration as input.
6. The corrected gas quantity is then calculated by multiplying the gas quantity from step 4 by the correction factor determined in step 5.
7. The mass of methane combusted is then calculated by multiplying the quantity of landfill gas from step 6 by the methane concentration, the density of methane and the flare destruction efficiency (assumed to be 90%).
8. The tons of methane that is destroyed in the baseline is calculated by multiplying the mass of methane from step 7 by an input value, which for this project is zero.
9. The quantity of emission reductions is then calculated by subtracting the methane destroyed in the baseline (step 8) from the methane determined in step 7 and multiplying the result by the global warming potential for methane.

10. The emission reductions are then aggregated for each time period to give a total value for the month.

5.3 Data security and archiving

All data and information gained over the crediting period of the project is stored and archived in an ISO 9001 approved filing system and kept for the life of the project, plus a further 2 years.

The data system uses 128 bit SSL Encryption for security. The system is further protected by user names and passwords to restrict access.

6 **Annexure A:** Emission reduction calculation workbook

See workbook: Chloorkop Workbook 2008.zip