VEOLIA
ENVIRONMENTAL SERVICES
Greenhouse Gas Department

CERs MONITORING REPORT

Onyx Alexandria Landfill Gas Capture and Flaring Project

Alexandria, Egypt

(Registration number n° 508)

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Period 15th December 2006 to the 30th September 2007

Version 0

INDEX

1. Introduction

Onyx Alexandria, Subsidiary of Veolia Environmental Services (formerly Onyx) has developed the 'Onyx Alexandria Landfill Gas Recovery Project', which has been successfully registered by the Executive Board of the UNFCCC on the 15th December 2006.

According to the Project Design Document (PDD), the Crediting Period started at the date of the project registration, the 15th December 2006 for a period of 10 years. This monitoring report covers the emission reductions (ER) achieved by the site between the 15th of December 2006 and the 30th September 2007.

The monitoring report has been established according the approved methodology ACM 001 Version 2, referred to within the PDD.

TÜV SÜD, an accredited company for the sector 13, has been appointed as a Designated Operational Entity (DOE), in order to carry out the verification of the emission reductions achieved by the project activity for this period.

2. Project

2.1. Description

Veolia Environmental Services is proposing a Clean Development Mechanism project activity at its Alexandria landfill facility located in the villages of Borg El Arab and El Hammam, Alexandria, Egypt. The methane produced by the waste within the landfill is collected and is combusted through flares reducing the GhG emissions into the atmosphere.

The system at the Borg El Arab landfill site is fitted with a leachate evaporator which is not operational yet.

Two flares are installed at Borg El Arab landfill, however only one is running at a given time. The second flare has been commissioned the 3rd April 2007.

The flare at the El Hammam started operation on the 1st August 2006. At a first stage, the instrumentation was not set as the adequate monitoring device was not designed yet. Periodic Manual records were taken during this period.

2.2. Project participants

Project participants for the CDM project are described below:

Veolia Environmental Services - 169 avenue Georges Clémenceau 92735 NANTERRE - FRANCE

Veolia Environmental Services - Onyx Alexandria for Complementary Services in Waste Treatment S.A.E. - Teleiba Street forom Kabbary Road, Moharram Bek – Alexandria - Egypt

World Bank - 1818 H Street, NW - Washington, DC – 20433 - USA

3. Volume of VERs monitored

3.1. Baseline

The baseline approved within the PDD is the partial release to the atmosphere of the methane produced by the anaerobic degradation of waste.

The PDD, in accordance with the approved consolidated methodology ACM0001, defines an adjustment factor of 20% valid for the duration of the crediting period.

3.2. Project emissions

The project emissions are measured by metering the quantity of methane burned through the flare.
The table below provides the details of the emission reductions for both sites:

tCO2	Methane Combusted incl. Flare efficiency (tCO2eq)	Offset due to the baseline (20%)	unburnt flared methane associacted with the project (for information only)	Fuel Emission of the project activity	Emission reductions (tCO2e)
> 15 Dec 06	1 336	267	107	10	1 059
Jan-07	2 361	472	189	20	1 869
Feb-07	2 244	449	180	17	1 778
Mar-07	2 324	465	186	21	1 838
Apr-07	2 265	453	181	31	1 781
May-07	2 203	441	176	22	1 740
Jun-07	2 481	496	199	24	1 961
Jul-07	2 897	579	232	31	2 286
Aug-07	2 902	580	232	23	2 299
Sep-07	2 602	520	208	22	2 060
Oct-07	-	-	-	-	-
Nov-07	-	-	-	-	-
Dec-07	-	-	-	-	-
Total (CER)	**22 280,5**	**4 456,1**	**1 782,4**	**212,1**	**17 612,3**

The emission reductions achieved by the project are calculated based on the quantity of methane combusted minus the emissions associated with the project activity (gas oil auxiliary generator). An adjustment factor of 20% is applied to the emission reductions, as described in the PDD.

Consequently, the total amount of CERs claimed for the period from 15th December 2006 to the 30th September 2007 is **17,612 CERs.**

4. Monitoring methodology

4.1. Brief description

The ERs are reported in tonnes of CO_2 (tCO_2) and are calculated based on the instrumentation described within the PDD. The monitoring report is then based on the following devices:

- A flowmeter (Nm^3/hour) monitoring the landfill gas being burnt through the flare.
- A landfill gas analyser (%CH_4)
- The flare temperature (°C)

As the leachate evaporator is not yet operational, it has not been equipped with monitoring instrumentation. However, the instrumentation will be installed in October 2007.

Different monitoring protocols were used during the period to integrate the maintenance and/or failure of equipment. The monitoring frequency evolves from one set of data per day to one set of data recorded every 5 minutes.

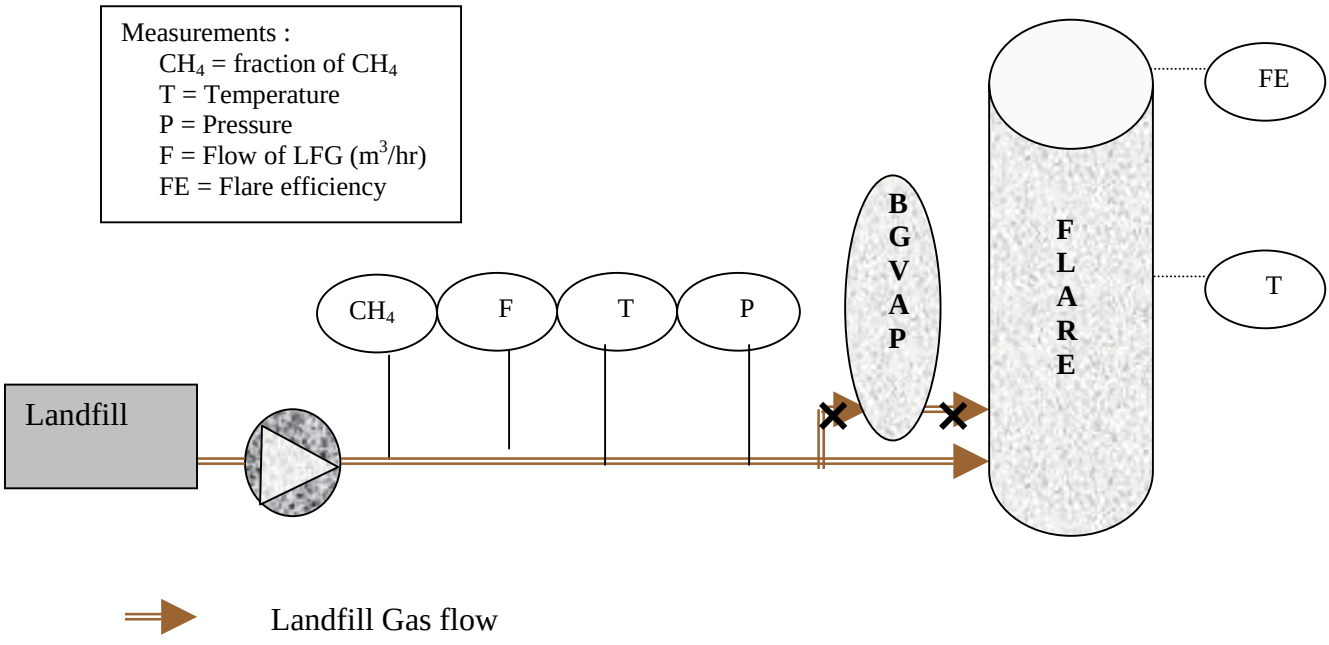
The gas flow and gas quality are aggregated monthly in order to calculate a normalised methane flow.

Manual readings were also recorded on a daily basis to complete the data recorded via the datalogger.

4.2. P&I Diagram

4.2.1. Borg El Arab

The diagram below represents the P&I Diagram of the Borg El Arab landfill.

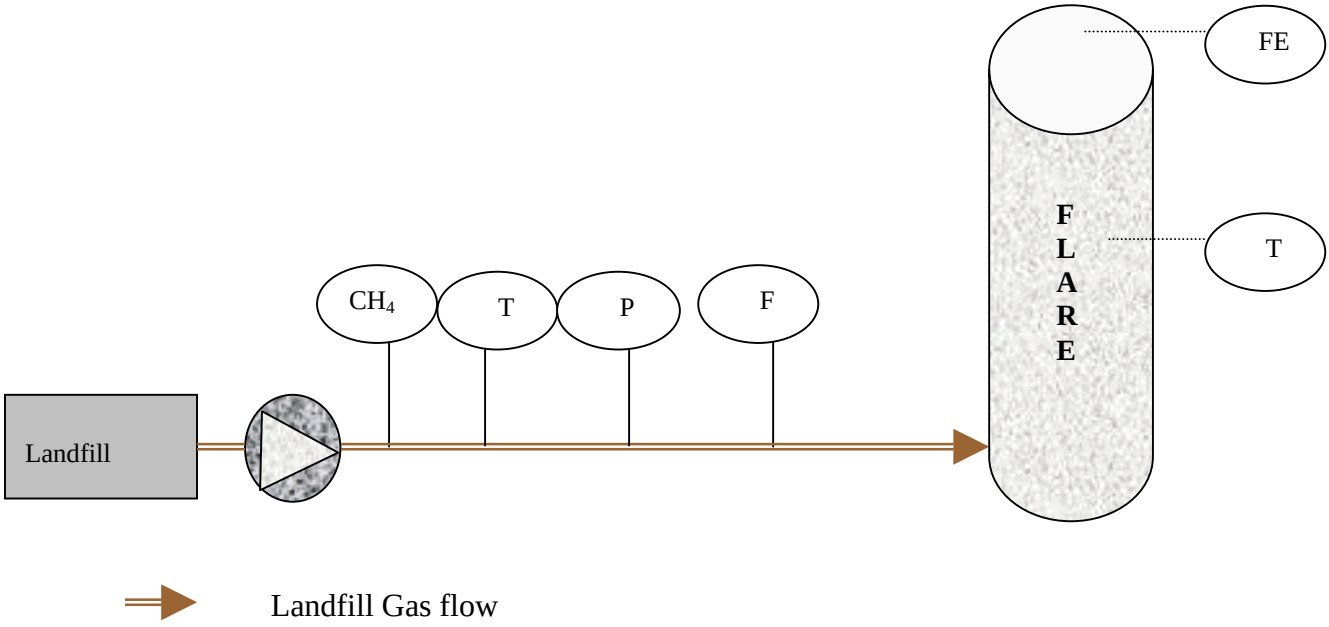


Although the leachate evaporator is installed, it has not been re-commissioned yet. Consequently, no landfill gas has been combusted in this unit.

As part of the project activity, another flare has been installed onsite and commissioned on the 3rd of April 2007. Both flares have been equipped with the instrumentation as shown above. The flares are not running simultaneously.

4.2.2. El Hammam

The gas extraction and flaring unit have been installed in August 2006 at El Hammam. The system is described below:



4.3. Emission reduction calculation

The emission reduction calculation is based on the monitoring plan described in the PDD, Onyx Alexandria Landfill Gas Capture and Flaring Project, version 4.

The emission reductions are defined as the difference of emissions in the baseline situation and in the project situation.

$$ER_y = \left[\sum_{m=1}^{12} \left(\frac{\frac{0.016}{22.4} \sum_{t=1}^{N} LFG_{flare_{t,m}} * W_{CH4t,m}}{Nm} \right) * RHm \right] * FE_{average} * (1 - AF) - C_{diesel} * CEF_{diesel}$$

Where,

ER_y is the quantity of emission reductions achieved in a given year y
$LFG_{flare, t, m}$ is the amount of landfill gas captured in Nm^3/hr and flared (and/or used within the leachate evaporator) at the time t.
$W_{CH4t,m}$ is the concentration of methane in the landfill gas at the time of the month m

N_m is the number of data available during the given month.
RH_m is the number of hours during a given month
$FE_{average}$: Average of the flare efficiency test
AF is the adjustment factor to integrate the baseline emissions. AF is equal to 20% for this project throughout the crediting period.
C_{diesel} is the consumption of diesel for the electricity generator for the site.
CEF_{diesel} is the Conversion emission factor for the diesel.
0.016 = molecular weight methane (t/kmol)
22.4 = molecular volume at 0 °C and 1000 hPa (m^3/kmol)

$$LFG_{flare,t,m} = LFG_{measured} * \frac{P_{site} * T_{normal}}{P_{normal} * T_{site}}$$

Where,
T_{normal} is the temperature is the reference temperature
P_{normal} is the reference pressure
P_{gas}: is the pressure of the gas
T_{gas} is the temperature of the gas

5. Data collection and analysis

5.1. Data collection principle

Every working day, data are recorded manually by a technician or a site engineer. In parallel, a data logger records the main parameters of the flare.

At El Hammam landfill, the data logger did not run correctly. Consequently, the data were recorded once a day from the start of the crediting period to the 31st of March. Then, the monitoring frequency increased to 9 set of records per day.

For Borg El Arab, the data logger was operational from the crediting period to the 31st of March. Then, periodic manual records where taken.

The manually recorded values were taken at a specific time, on a daily basis, by the flare operator.

5.2. Data analysis

Pressure, temperature and landfill gas flow are monitored in order to normalise the gas flow, following the equation below:

$$F_{norm} = F_{measurred} * \frac{293.14 * (P_{gas})}{1.013 * (273.15 + T)}$$

The number of running hours is directly monitored by a monitoring device and reported through daily log book.

At Borg El Arab, between the 15th December 2006 and the 31st of March 2007, the running hours are calculated from the data logger data (one set of data every 5 minutes). When no data are available the recorded running hours are used.

5.2.1. Data storage

Recorded data are archived within one file for each site:

- 'Monitoring data 07 EH vers 0.xls' for the El Hammam landfill
- 'Monitoring data BEA vers 0.xls' for the Borg El Arab landfill

6. Treatment of invalid data:

From time to time the instrumentation or the data logger can be in maintenance, faulty or down. This section provides the methodologies used to:

- Identify data requiring a manual check
- Correct data if required.

6.1. Identification of data requiring manual check

Data issued from the data logger are automatically checked with several coherence tests. If data fails one coherence check, it will be checked manually. The coherence tests are listed below:

- **Methane concentration:** If the methane concentration is below 20% or above 65%, the coherence test indicates the value 0, and 1 otherwise.
- **Flare temperature**: If the flare temperature is below 500°C or above 1500°C, the coherence test indicates the value 0, and 1 otherwise.
- **All data:** if the difference between 3 consecutive data is identical, the coherence test indicates the value 0, and 1 otherwise.

6.1.1. Facility status

A counter is installed at each facility in order to account for the running hours of the flare. This value is used during the crediting period, except for the month of December 2006 to March 2007, where the information from the datalogger could be used.

When data logger is used, flare operation is monitored through the flare stack temperature. The flare is considered burning landfill gas when the temperature is above 100°C.

6.1.2. Pressure at the flowmeter

The relative pressure of the LFG and the atmospheric pressure are monitored as the other parameters. In case of missing data the following conservative approach has been considered: Pressure at the flowmeter is determined from the atmospheric pressure monitored at the Alexandria Airport. The landfill gas pressure at the flowmeter is slightly higher than the atmospheric pressure. A conservative approach is then to consider the lowest pressure.

Borg El Arab

The monitoring carried out from the 25/01/2007 to the 27/01/07 at Borg El Arab, shows that the relative pressure at the flowmeter is at all times lower than 5 mbar for the site. From a physical point of view the relative pressure cannot be negative. This has been confirmed by the regular monitoring of this parameter in 2007, where the relative pressure varies between 0.2 and 2.3 mbar from April to September 2007:

At El Hammam, a statistical study has been carried out from 28/01/07 to 30/01/07 . It shows that the relative pressure at the flowmeter is comprised between 0 and 10 mbar for the site. This has been confirmed by the regular monitoring of this parameter in 2007, where the relative pressure range from 1.20 to 9.1 mbar from April to September 2007 and the average is 7.15 mbar.

Consequently, in the absence of valid measurements, the most conservative value to be used is the atmospheric pressure. If no data for the atmospheric pressure is available on-site, the lowest daily value monitored at the nearby Alexandria airport will be used.

$P_{gas} = P_{atm} + P_{relative}$

Where:

P_{gas} is the absolute pressure at the Flowmeter

- Value recorded
- Or if no data available, the value is 0

P_{atm} is the atmospheric pressure

- Value recorded
- Or if not available, Lowest daily value monitored by the Alexandria airport

The atmospheric pressure historic for Alexandria airport is available on:
http://www.wunderground.com/history/airport/HEAX/2007/1/25/CustomHistory.html?dayend=30&monthend=1&yearend=2007&req_city=NA&req_state=NA&req_statename=NA

- **P**$_{relative}$ is the measured relative pressure reading of the landfill gas at the flowmeter.

6.1.3. LFG Temperature at the flowmeter

The LFG temperature is used to normalise the landfill gas flow to be burnt within the flare.

Under normal operation conditions, LFG temperature is monitored. In the case, it is not available the highest valid value of the considered period is used.

Borg El Arab

The extraction and flaring unit is fitted with a temperature switch set at 80°C. It aims at protecting the blowers against over heating by shutting done the gas supply should this temperature be reached. It means that the landfill gas temperature never exceeds this temperature. The landfill gas temperature has been measured in 2007 during the hottest months of the year (between the first of April and the 9th of September). The maximum temperature observed was on the 6 and on the 8th of May, with 42.3°C, whereas the average during the hot period is 26.2 °C. In order to be very conservative, a default LFG temperature of 42.3°C was used in the absence of recorded data.

El Hammam

The extraction and flaring unit is fitted with a temperature switch set at 80°C. It aims at protecting the blowers against over heating by shutting done the gas supply should this temperature be reached. It means that the landfill gas temperature never exceeds this temperature. In order to obtain a better estimate of the temperature of the landfill gas, the landfill gas temperature has been measured in 2007 during the hottest months of the year (between the first of April to the 9th of September). The maximum temperature recorded was on the 24/04/07, where the temperature reaches 89,3°C. During this period, the temperature switch/temperature gauge was not functioning properly.The problem has been fixed on the 28th of April 2007.

If this period is excluded (April month) due to a failure of monitoring equipment, the maximum temperature was reached on the 07/05/2007 with a maximum temperature of 50.4°C. This value is considered as conservative since the average landfill gas temperature observed between April and September 2007 was 33.2°C. It has been used in the absence of recorded data.

The flowmeters have been set up to provide a correct reading in normal condition at 20°C. Consequently, to normalise the landfill gas flow, the formulae shall only be applied between 20 and 45°C.

6.1.4. Flare efficiency

The efficiency of the flare was monitored though an analysis carried out on the 18 march 2007 at Borg el Arab and at el Hammam Landfill. The analysis was carried our by an independent laboratory (NCESOH). The result of the analysis shows that the flare efficiency ranges from 99.93 to 99.97 %.

The table below summarizes the main findings:

	BEA Flare 1	BEA Flare 2	El Hammam
Landfill Gas Inlet			
CH_4 %	29%	30.04%	37.005%
O_2 %	9.74%	9.94%	7.224%

Exhaust gas

$CH_4(mg/m^3)$	17	28	14
O_2 %	10.2%	9.8%	9.7%

Flare Efficiency	**99.96 %**	**96.93 %**	**99.97 %**

The flare efficiency has been calculated applying the Tool to determine project emissions from flaring gases containing methane (EB28, Annex 13).

However, in order to comply with the recommendation of the EB, the default **efficiency factor of 90%** has been used.

ANNEXE 1

The Diesel oil emission factor has been calculated as follows

Diesel oil	tCO2/TJ	74,1	2006 IPCC Guidelines for national Greenhouse Gas Inventories, Volume 2, section 2, P16
Diesel Oil	kJ/kg	43 000	2006 IPCC Guidelines for national Greenhouse Gas Inventories, Volume 2, section 1, P18
Diesel oil density max	kg/L	0,8516	Special Issues Paper 9; 2004, http://www.iea.org/Textbase/work/2004/eswg/SIP9.pdf,
Diesel Emission factor	kCO2/L	2,713	Calculated from the above

The atmospheric pressure historic for Alexandria is available on:
http://www.wunderground.com/history/airport/HEAX/2007/1/25/CustomHistory.html?dayend=30&monthend=1&yearend=2007&req_city=NA&req_state=NA&req_statename=NA